Forest Restoration in Landscapes

WWF's Forests for Life Programme

WWF's vision for the forests of the world, shared with its long-standing partner, the World Conservation Union (IUCN), is that "the world will have more extensive, more diverse and higher-quality forest landscapes which will meet human needs and aspirations fairly, while conserving biological diversity and fulfilling the ecosystem functions necessary for all life on Earth."

WWF's approach to forest conservation has evolved over time into a global programme of integrated field and policy activities aimed at the protection, responsible management, and restoration of forests, whilst at the same time working to address the key threats which could potentially undermine these efforts. Those of particular concern to WWF are illegal logging and forest crime, conversion of forests to plantation crops of palm oil and soy, forest fires, and climate change.

The Forests for Life Programme consists of a global network of more than 250 staff working on over 300 projects in nearly 90 countries. Regional forest officers coordinate efforts in each of the five regions, supported by a core team based at WWF International in Switzerland. The programme also draws on the complementary skills and support of partners to help achieve its goals.

WWF and Restoring Forests and Their Functions in Landscapes

WWF has adopted a target for forest restoration: "By 2020, restore forest goods, services, and processes in 20 landscapes of outstanding importance within priority ecoregions to regain ecological integrity and enhance human well-being," which is issued as a challenge to the world.

As its contribution toward the target, WWF is actively developing a portfolio of forest landscape restoration programmes, and also working with governments, international organisations, indigenous peoples, and other communities to pursue its work on forest restoration within a landscape context, by doing the following:

- Initiating and facilitating projects/programmes within landscapes of high restoration priority in WWF Global 200 Ecoregions
- Assisting others, and building local capacity to plan and implement forest restoration interventions
- Developing suitable monitoring tools and techniques to measure progress
- Documenting, exchanging and disseminating lessons learnt and experiences

For more information please see the Web site: http://www.panda.org/forests/restoration/.

Stephanie Mansourian
Daniel Vallauri
Nigel Dudley

Forest Restoration in Landscapes

Beyond Planting Trees

With 28 Illustrations

Springer

Stephanie Mansourian
Consultant
WWF International
Avenue Mont Blanc
Gland 1196
Switzerland

Daniel Vallauri
WWF France
6 Rue des Fabres
13001 Marseille
France

Nigel Dudley
Consultant
Equilibrium
47 The Quays
Cumberland Road
BS1 6UQ
United Kingdom

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Foreword

Is it a sign of the times that last year the Nobel committee chose to award the Nobel Peace prize to Wangari Maathai for having planted 30 million trees? We believe so. We think that while in the 20th century conservation made significant progress on setting up a global protected area network, the 21st century will be a time of forest restoration. The fact that Wangari Maathai is the first African woman to receive such an honourable distinction is in itself a major accomplishment. What is even more remarkable is that, for the first time, this highly esteemed prize, which has long been associated with political feats, was given for an environmental achievement. And not just any environmental achievement, but forest restoration. It is a comfort to see that it is not just us at WWF, the global conservation organisation, who believe forest restoration to be of global significance, but that the Nobel committee is in agreement. The committee members are not the only ones, I should add. In 2003 WWF, IUCN, (the World Conservation Union), and the United Kingdom Forestry Commission launched a global partnership on forest landscape restoration to raise awareness about the importance of the restoration of forests and to invite all decision makers and influential organisations to join in a movement to restore forests. Today this partnership includes governments as diverse as Switzerland, Finland, El Salvador, and Italy, and international organisations such as the United Nations Food and Agriculture Organisation (FAO), the Centre for International Forestry Research (CIFOR), the International Tropical Timber Organisation (ITTO), and it continues to grow.

Too much damage has already been done for us to afford to ignore our dwindling forest resources. If we wait until tomorrow to restore forests, it will be too late. If too little is left, it will take longer, will be more difficult, and will cost much more to begin restoring a healthy forest—and it may also be too late.

At WWF we are aware of this urgency, and with this book we invite practitioners, researchers, and decision makers to join us in doing something practical about our forests. As the Nobel committee has noted, too many wars are fought over dwindling resources. If we do not do something about it, this may well be the new security scourge jeopardising our future and that of our children.

Chief Emeka Anyaoku
President, WWF International

Preface

For WWF, the global conservation organisation, achieving lasting forest conservation requires working on a large scale and integrating global strategies and policies to protect, manage, and restore forests.

In an ideal world, restoration would not be necessary; however, today many forest habitats are already so damaged that their long-term survival, and the ecological services they provide, are in doubt and we urgently need to consider restoration if we are to achieve conservation and sustain the livelihoods of people dependent on nature.

Forest conservation strategies that rely solely on protected areas and sustainable management have proved insufficient either to secure biodiversity or to stabilise the environment. The United Nations Environment Programme now classifies a large proportion of the world's land surface as "degraded," and this degradation is creating a wide range of ecological, social, and economic problems. Forest loss and degradation is a particularly important element in this worldwide problem with annual global estimates of forest loss being as high as 16 million hectares, and those for degradation even higher. Reversing this damage is one of the largest and most complex challenges of the 21st century.

An analysis of the WWF Global 200 ecoregions—those areas of greatest importance for biodiversity on a global scale—demonstrates the problems. For example, over 20 percent of forest ecoregions have already lost at least 85 percent of their forests: sometimes only 1 to 2 percent remains. Deforestation is a key threat to water quality in 59 percent of freshwater ecoregions. Many of the charismatic species that are flagships for conservation (African elephant, Asian elephant, great apes, rhinoceros, giant panda, and tiger) are threatened by forest loss, fragmentation, and degradation.

Forest loss is not only of concern to conservationists. According to the World Bank about 1 billion people in the developing world depend either directly or indirectly on goods and services from the forests, and these provide an essential safety net to many of the world's poorest people.

WWF's mission is to stop degradation on our planet and to achieve a world where humans and nature live in harmony together. Decades of overexploitation have brought us to a world characterised by imbalance: imbalance between rich and poor, imbalance between supply of natural resources and demand for natural resources, imbalance between biodiversity needs and human needs. WWF's approach to forest restoration, in the context of ecoregion conservation, seeks to redress these imbalances in order to restore healthy landscapes that are able to benefit both biodiversity and people.

This book harnesses the expertise of over 70 authors drawing on a wealth of practical experience and a wide range of expertise. It is practical, hands on, and illustrated with numerous examples from across the world. The aim is to synthesise in an easily accessible format the knowledge and expertise that exists and also to highlight areas that need further work. We are hoping to encourage field staff—ours and those of other organisations interested in conservation and development—who are out there dealing with the impacts of forest loss and degradation, to apply landscape-scale forest restoration as an approach to help them meet their conservation goals and our conservation goals.

Dr. Chris Hails
Programme Director, WWF International

Note from the Editors

This book has been designed to help readers understand how forest restoration can be integrated with other aspects of conservation and development in landscapes. Parts A, B, and C introduce the elements for planning and implementing restoration on a broad scale, including a range of social, political, and economic considerations that will influence and that will be influenced by any large-scale restoration effort. Part D focusses on more specific issues, including restoration in different forest habitats and for different reasons.

While we believe that successful restoration generally needs to be planned on a large scale, it will probably be implemented in one or more sites within a landscape, and the book similarly starts with very broad-scale considerations and then focusses increasingly on actions that can be taken at the site. Parts A, B, and C thus provide what could be seen as the foundations, and part D provides some much more specific tools and considerations that are applicable in different situations. We recommend that you read the relevant chapters in part D once you have read all of parts A, B, and C.

The final part (part E) discusses some of the lessons learned to date from practical experiences and recommendations for future work related to forest restoration on a large scale.

Each chapter starts with an introduction to the issue, illustrating it with a series of brief thumbnail examples, showing, where appropriate, both good and bad practice. Some useful tools are then listed followed by a brief description of future work required and finally and importantly a set of references. We cover a vast subject here and each chapter is as a result kept deliberately short, we can only introduce many of the techniques described but have provided detailed sources for those who wish to follow up specific issues in greater detail.

The book includes contributions from a large number of authors. Although we have all been writing within the framework of forest landscape restoration, there are inevitably different nuances in how this should be interpreted and applied. What follows is a set of experienced opinions rather than a rigid blueprint. We will in turn very much appreciate hearing feedback, criticism, and experience from users.

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The book represents a collection of individual essays and are the opinions of the authors and should not be seen as representing opinions from their respective employers or organisations. Needless to say, despite the enormous help we have received in putting this book together, any remaining errors of fact or opinion remain the responsibility of the editors.

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Acronyms

ACG—Area Conservación Guanacaste
CAP—common agriculture policy
CATIE—Centro Agronómico Tropical de Investigación y Enseñanza
CBD—Convention on Biological Diversity
CBFM—community-based forest management
CDM—clean development mechanism
CEAM—Centro de Estudios Ambientales Mediterráneos (Mediterranean Centre for Environmental Studies)
CIFOR—Centre for International Forestry Research
DFID—U.K. Department for International Development
DG—Directorate General
EC—European Commission
ECCM—Edinburgh Centre for Carbon Management
ERC—ecoregion conservation
EU—European Union
FAO—United Nations Food and Agriculture Organisation
FLO—Fair-Trade Labelling Organisation
FLR—forest landscape restoration
FSC—Forest Stewardship Council
FONAFIFO—Fondo Nacional de Financiamiento Forestal (National Fund for Financing Forestry)
GEF—global environment facility
GIS—geographical information system
GTZ—Deutsche Gesellschaft für Technische Zusammenarbeit (German Company for International Technical Cooperation)
HCVF—high conservation value forest
IAS—invasive alien species
ICDP—Integrated Conservation and Development Programme
IFOAM—The International Federation of Organic Agriculture Movements
IMF—International Monetary Fund
IPF—Intergovernmental Panel on Forests
ITTO—International Tropical Timber Organisation
IUCN—The World Conservation Union
IISD—International Institute for Sustainable Development
IIED—International Institute for Environment and Development
LULUCF—Land Use, Land-Use Change, and Forestry
MOSAIC—Management of Strategic Areas for Integrated Conservation
NTFP—nontimber forest products
NGO—Nongovernmental organisation
ODA—Overseas Development Assistance
PES—payment for environmental services
PRA—participatory rural appraisal
PVA—population viability analysis
RIL—reduced-impact logging
RRA—rapid rural appraisal
REACTION—Restoration Actions to Combat Desertification in the Northern Mediterranean
SAPARD—Special Action for Pre-Accession Measures for Agriculture and Rural Development
SERI—Society for Ecological Restoration International
SDC—Swiss Agency for Development and Cooperation
SEI—Stockholm Environment Institute
SLU—Swedish University of Agricultural Sciences
TDF—tropical dry forests
TNC—The Nature Conservancy
UNCCD—United Nations Convention to Combat Desertification
UNFCCC—United Nations Framework Convention on Climate Change
USAID—U.S. Agency for International Development
WWF—Worldwide Fund for Nature (also known as World Wildlife Fund in North America)

Contributors' List

Mark Aldrich
Manager, Forest Landscape Restoration
Forests for Life Programme
WWF International
Av. Mont Blanc
1196 Gland, Switzerland
E-mail: maldrich@wwfint.org

Thomas F. Alnutt
Senior Conservation Specialist
Conservation Science Programme
World Wildlife Fund–US, Suite 200
Washington, DC 20037
E-mail: tom.allnutt@gmail.com

Everaldo Almeida
CIFOR Regional Office for Latin America
c/o EMBRAPA Amazônia Oriental
Trav. Dr. Enéas Pinheiro s/n
CEP 66.010-080 Belém—Pará, Brazil
E-mail: e.almeida@cgiar.org

James Aronson
Restoration Ecology Group
CEFE (CNRS-U.M.R. 5175)
1919, Route de Mende
F-34293 Montpellier, France
E-mail: james.aronson@cefe.cnrs.fr

Martin Ashby
Sion Chapel
Llanwrin
Powys
SY20 8QH
Wales, United Kingdom
E-mail: martin.ashby@Martin-Ashby.demon.co.uk

Eduard Plana
Head of Forest Fire Working Group
Forest Technology Centre of Catalonia
Area de Política Forestal
Pujada del Seminari s/n
Solsona 25280, Spain
E-mail: eduard.plana@ctfc.es

Nora Berrahmouni Corkland Programme Coordinator
WWF Mediterranean Programme Office
Via Po 25/C
00198 Rome, Italy
E-mail: nberrahmouni@wwmedpo.org

Jennifer Biringer
World Wildlife Fund–US, Suite 200
Washington, DC 20037
E-mail: jennifer.biringer@wwfus.org

Silvio Brienza, Jr.
Embrapa Amazônia Oriental,
Trav. Dr. Enéas Pinheiro s/n 66095-100
Belém—Pará, Brazil
E-mail: brienza@cpatu.embrapa.br

Katrina Brown
Professor of Development Studies
School of Development Studies
University of East Anglia
Norwich
NR4 7TJ, United Kingdom
E-mail: k.brown@uea.ac.uk

Antonio P. Carandang
Forestry Consultant
Main Street
Marymount Village, Anos
Los Banos,
Laguna 4030, Philippines
E-mail: apc@laguna.net

Marc Castellnou
Forestry Engineer
GRAF-Fire Service
Government of Catalonia
Ctra. Universitat Autònoma, s/n
08290 Cerdanyola del Vallès (Vallès Occidental)
Spain
E-mail: incendis@yahoo.com

Rufi Cerdan
Dr. in Geography
Autonomous University of Barcelona
Campus de la UAB, Edifici B
08193 Bellaterra
Spain
E-mail: rufi.cerdan@uab.es

Soh Koon Chng
Communications Manager
WWF International
Av. Mont Blanc
1196 Gland, Switzerland
E-mail: skchng@wwfint.org

Unna Chokkalingam
Scientist
Environmental Services and Sustainable Use of Forests Programme
Centre for International Forestry Research (CIFOR)
P.O. Box 6596 JKPWB
Jakarta 10065, Indonesia
E-mail: u.chokkalingam@cgiar.org

Nigel Dudley
Consultant
Equilibrium
47 The Quays
Cumberland Road
Bristol
BS1 6UQ, United Kingdom
E-mail: equilibrium@compuserve.com

Simon Dufour
PhD student
CNRS UMR 5600
18 rue Chevreul
69362 Lyon Cedex 07, France
E-mail: sim_dufour@yahoo.fr

Chris Elliott
Director, Forest Programme
WWF International
Av. Mont Blanc
1196 Gland, Switzerland
E-mail: celliott@wwfint.org

Thomas K. Erdmann
Regional Coordinator
ERI Madagascar Project
c/o Development Alternatives, Inc.
7250 Woodmont Ave.
Suite 200
Bethesda, MD 20814
E-mail: tom_erdmann@dai.com

Alan Watson Featherstone
Trees for Life
The Park
Findhorn Bay
Forres IV36 3TZ
Scotland, United Kingdom
E-mail: trees@findhorn.org

Don Gilmour
Environmental Consultant
42 Mindarie Cres Wellington Point
4160 Queensland, Australia
E-mail: gilmour@itxpress.com.au

Manuel Guariguata
Environmental Affairs Officer
United Nations Environment Programme
Secretariat of the Convention on Biological Diversity
413 St. Jacques, Suite 800
Montreal, Quebec, Canada
E-mail: manuel.guariguata@biodiv.org

Tini Gumartini
Environmental Services and Sustainable Use of Forests Programme
Centre for International Forestry Research (CIFOR)
P.O. Box 6596 JKPWB
Jakarta 10065, Indonesia
E-mail: gumartini@cgiar.org

Lara J. Hansen
Chief Scientist for Climate Change
WWF
1250 24th Street NW
Washington, DC 20016
E-mail: lara.hansen@wwfus.org

Mary Hobley
Consultant
Glebe House
Chard Street
Thorncombe
Chard TA20 4NE, United Kingdom
E-mail: mary@maryhobley.co.uk

Marja Hokkanen
Metsähallitus
Natural Heritage Services
P.O Box 94
01301 Vantaa, Finland
E-mail: marja.hokkanen@metsa.fi

Silvia Holz
Ph.D. candidate,
National University of Buenos Aires
Departamento de Ecología, Genética y Evolución
(4to Piso, Pabellón II).
Facultad de Ciencias Exactas y Naturales
Güiraldes 2620. Ciudad Universitaria
CP: 1428, Ciudad de Buenos Aires, Argentina
E-mail: silviaholz@yahoo.com.ar

José Manuel Nicolau Ibarra
Profesor Titular de Ecología
Departamento de Ecología
Universidad de Alcalá
28871 Alcalá de Henares
Madrid, Spain
E-mail: josem.nicolau@uah.es

Tanguy Jaffré
Directeur de Recherche de l'IRD
Laboratoire de Botanique et d'Ecologie Végétale
Centre IRD
BP A5
F-98848 Noumea Cedex
Nouvelle-Calédonie, France
E-mail: jaffre@noumea.ird.nc

Wil de Jong
Professor
Japan Centre for Area Studies, National Museum of Ethnology
10-1 Senri Expo Park, Suita
Osaka 565-8511, Japan
E-mail: wdejong@idc.minpaku.ac.jp

Scott Jones
Forests for People Group
Centre for International Development and Training
University of Wolverhampton
Telford Campus
TF2 9NT, United Kingdom
E-mail: tiger.moth@ntlworld.com

Gladwin Joseph
Director and Fellow
Ashoka Trust for Research in Ecology and the Environment
Hebbal
Bangalore 560024, India
E-mail: gladwin@atree.org

Harri Karjalainen
Head, Forest Programme
WWF Finland
Lintulahdenkatu 10
00500 Helsinki, Finland
E-mail: harri.karjalainen@wwf.fi

David Lamb
School of Integrated Biology
University of Queensland
Brisbane, 4072, Australia
E-mail: d.lamb@botany.uq.edu.au

Abel Meza Lopez
Centre for International Forestry Research (CIFOR)
Apdo. 558, Carretera Fdco. Basadre km 4,200
Pucallpa, Peru
E-mail: cifor-peru@cgiar.org; a.meza@cgiar.org

Colby Loucks
Conservation Science Programme
World Wildlife Fund–U.S., Suite 200
Washington, DC 20037
E-mail: colby.loucks@wwfus.org

Porter P. Lowry II
Curator and Head, Africa and Madagascar Department
Missouri Botanical Garden
P.O. Box 299
St. Louis, Missouri 63166-0299,
and
Département Systématique et Evolution, Muséum National d'Histoire Naturelle
C.P. 39
57 rue Cuvier
75231 Paris CEDEX 05, France
E-mail: Pete.Lowry@mobot.org

Stephanie Mansourian
Consultant—WWF International
10 rte de Burtigny
1268 Begnins, Switzerland
E-mail: stephanie.mansourian@worldcom.ch

Jeffrey A. McNeely
Chief Scientist
IUCN—The World Conservation Union
Rue Mauverney, 28
1196 Gland, Switzerland
E-mail: jam@iucn.org

Florencia Montagnini
Professor in the Practice of Tropical Forestry
Yale University
School of Forestry and Environmental Studies
370 Prospect St.
New Haven, CT 06511
E-mail: florencia.montagnini@yale.edu

Peter Moore
Fire Management and Policy Specialist
Metis Associates—Strategic Analysts
P.O. Box 1772
Bowral NSW 2576, Australia
E-mail: metis@metis-associates.com

Mariano Moreno de las Heras
PhD Student
Departamento de Ecología
Edificio de Ciencias
Universidad de Alcalá
28871 Alcalá de Henares
Madrid, Spain
E-mail: mariano.moreno@uah.es.

John Morrison
Deputy Director
Conservation Science Programme
World Wildlife Fund–U.S., Suite 200
Washington, DC 20037
E-mail: john.morrison@wwfus.org

Murniati
Forestry Research and Development Agency (FORDA)
Jalan Gunung Batu No. 5
Bogor, Indonesia
E-mail: murniati@forda.org

Robert Nasi
Principal Scientist
Programme on Environmental Services and Sustainable Use of Forests
Centre for International Forestry Research—CIRAD
Campus International de Baillarguet TA 10/D
34398 Montpellier Cedex 5, France
E-mail: r.nasi@cgiar.org

Ani Adiwinata Nawir
Scientist
Forests and Livelihoods Programme
Centre for International Forestry Research (CIFOR)
P.O. Box 6596 JKPWB
Jakarta 10065, Indonesia
E-mail: a.nawir@cgiar.org

Adrian Newton
Senior Lecturer
School of Conservation Sciences
Bournemouth University
Talbot Campus
Fern Barrow
Poole
Dorset BH12 5BB, United Kingdom
E-mail: anewton@bournemouth.ac.uk

Nguyen Thi Dao
Annamites Ecoregion Conservation Manager, Vietnam
WWF Indochina Programme
40 Cat Linh
Ba Dinh District
Hanoi, Vietnam
E-mail: dao@wwfvn.org.vn

Sheila O'Connor
Director, Conservation Measures and Audits
WWF International
39 Stoke Gabriel Rd.
Galmpton nr Brixham
Devon TQ5 0NQ, United Kingdom
E-mail: soconnor@wwfint.org

Jessica Orrego
Forestry Project Manager
Edinburgh Centre for Carbon Management
Tower Mains Studios
18F Liberton Brae
Edinburgh, EH16 6AE, United Kingdom
E-mail: jessica.orrego@eccm.uk.com

Gonzalo Oviedo
Senior Advisor, Social Policy
IUCN–The World Conservation Union
28 Rue Mauverney
1196 Gland, Switzerland
E-mail: gonzalo.oviedo@incn.org

Jussi Päivinen
Metsähallitus, Natural Heritage Services
P.O. Box 36
40101 Jyväskylä, Finland
E-mail: jussi.paivinen@metsa.fi

Hervé Piégay
Researcher
CNRS UMR 5600
18 rue Chevreul
69362 Lyon Cedex 07, France
E-mail: piegay@univ-lyon3.fr

Guillermo Placci
Consultant
Constitución 237
5800—Río Cuarto, Cba, Argentina
E-mail: guillermoplacci@ciudad.com.ar

Gérard Rambeloarisoa
Forest Programme Officer
WWF Madagascar
WWF Madagascar and West Indian Ocean Programme Office
B.P. 738
Antananarivo 101, Madagascar
E-mail: grambeloarisoa@wwf.mg

Pedro Regato
Head, Forest Programme
WWF Mediterranean Programme Office
Via Po 25/C
00198 Rome, Italy
E-mail: pregato@wwfmedpo.org

José M. Rey Benayas
Dpto. de Ecología
Edificio de Ciencias
Universidad de Alcalá
28871 Alcalá de Henares, Spain
E-mail: josem.rey@uah.es

Doreen Robinson
Biodiversity and Natural Resources Specialist
USAID
1300 Pennsylvania Ave. NW
Ronald Reagan Building 3.08
Washington, DC 20523-3800
E-mail: drobinson@usaid.gov

Triagung Rooswiadji
Programme Manager
WWF Indonesia's Nusa Tenggara Programme
Jl. DODIKLAT No. 2
Kelurahan Oebubu
Kupang, NTT 8500, Indonesia
E-mail: triagung@kupang.wasantara.net.id

Lukas Rumboko Wibowo
Forestry Research and Development Agency (FORDA)
Jalan Gunung Batu No. 5
Bogor, Indonesia
E-mail: lukas_19672000@yahoo.com

Cesar Sabogal
Senior Scientist, Tropical Silviculture and Forest Management
CIFOR Regional Office for Latin America
c/o EMBRAPA Amazônia Oriental
Trav. Dr. Enéas Pinheiro s/n,
CEP 66.010-080 Belém
Pará, Brazil
E-mail: c.sabogal@cgiar.org

Nick Salafsky
Co-Director
Foundations of Success
4109 Maryland Ave.
Bethesda, MD 20816
E-mail: Nick@FOSonline.org

Daniel W. Salzer
Conservation Measures Manager
The Nature Conservancy
Conservation Measures Group
821 SE 14th Ave.
Portland, OR 97214
E-mail: dsalzer@tnc.org

Jeffrey Sayer
Senior Advisor
WWF International
Av. Mont Blanc
1196 Gland, Switzerland
E-mail: jsayer@wwfint.org

Kirsten Schuyt
Resource Economist
WWF International
Av. Mont Blanc
1196 Gland, Switzerland
E-mail: Kschuyt@wwfint.org

Sue Stolton
Consultant
Equilibrium
47 The Quays, Cumberland Road
Bristol
BS1 6UQ, United Kingdom
E-mail: equilibrium@compuserve.com

Takeshi Toma
Senior Scientist
Environmental Services and Sustainable Use of Forests Programme
Centre for International Forestry Research (CIFOR)
P.O. Box 6596 JKPWB,
Jakarta 10065, Indonesia
E-mail: t.toma@cgiar.org
Present address:
Associate Research Coordinator
Research Planning and Coordination Division, Forestry and Forest Products Research Institute (FFPRI)
1 Matsunosato, Tsukuba, Ibaraki 305-8687, Japan
E-mail: toma@affrc.go.jp

Daniel Vallauri
WWF France
6 Rue des Fabres
13001 Marseille, France
E-mail: dvallauri@wwf.fr

Ramon Vallejo
CEAM,
Parque Tecnológico,
Ch. Darwin 14
E-46980 Paterna, Spain
E-mail: vvallejo@ub.edu

Lawrence R. Walker
Professor of Biology
Department of Biological Sciences
University of Nevada, Las Vegas
Box 454004
4505 Maryland Parkway
Las Vegas, NV 89154-4004
E-mail: walker@unlv.nevada.edu

Steve Whisenant
Professor and Department Head
Department of Rangeland Ecology and Management
2126-TAMU
Texas A&M University
College Station, TX 77843-2126
E-mail: rangerider@mac.com

Eva Wollenberg
Senior Scientist
Forests and Governance Programme
Centre for International Forestry Research (CIFOR)
P.O. Box 6596 JKPWB
Jakarta 10065, Indonesia
E-mail: L.wollenberg@cgiar.org

Zhou Zaizhi
Research Institute of Tropical Forestry
Chinese Academy of Forestry
Longdong, Guangzhou 510520, China
E-mail: zzzhoucn@21cn.com

Part A
Toward a Wider Perspective in Forest Restoration

Section I
Introducing Forest Landscape Restoration

1 Forest Landscape Restoration in Context

Nigel Dudley, Stephanie Mansourian, and Daniel Vallauri

Key Points to Retain

Forest landscape restoration is grounded in ecoregion conservation and is defined as a planned process that aims to regain ecological integrity and enhance human well-being in deforested or degraded landscapes.

Such an approach helps achieve a balance between human needs and those of biodiversity by restoring a range of forest functions within a landscape and accepting the trade-offs that result.

1. Background and Explanation of the Issue

People have been actively using forests since long before the beginning of history. The oldest known written story, the *Epic of Gilgamesh* recorded on 12 cuneiform tablets in Assyria in the seventh century B.C., includes reference to the problems of forest loss. The need for good tree husbandry was stressed in Virgil's pastoral poem *The Georgics* in 30 B.C., written to promote rural values within the Roman Empire. The oldest records of forest management in the world have been kept without a break for 2000 years in Japan, relating to forests managed to produce timber for Shinto temples. The need for large-scale restoration has also been recognised for centuries; for example, the English pamphleteer John Evelyn wrote a tract calling for major tree planting during the time of Queen Elizabeth I in the 1600s. In more recent times, forest departments around the world have developed major efforts at reforestation in Europe, eastern North America, Australia, New Zealand, and increasingly in parts of the tropics.[1] In the last 20 years, hundreds of aid and conservation projects have promoted and carried out tree planting schemes and the development of tree nurseries, aimed at both supplying goods such as fuelwood and at restoring ecological functions and protecting biodiversity. Following the Society for Ecological Restoration International (SERI) and its chapters around the world, the scientific knowledge on ecological restoration has been conceptualised and applied to many different types of ecosystem, including forest landscapes. Good books have already been published.[2] Why then do we need another book about restoration?

The arguments for forest restoration are becoming more compelling. Forest loss and degradation is a worldwide problem, with net annual estimates of forest loss being 9.4 million hectares throughout the 1990s[3] and those for degradation uncalculated but universally agreed to be even higher. The most severe losses are currently concentrated mainly, although not exclusively, in the tropics, with

[1] For an overview see Perlin, 1991.
[2] Perrow and Davy; 2002, SERI, 2002; Whisenant, 1999.
[3] FAO, 2001.

the temperate countries gradually recovering forest area if not necessarily quality after severe deforestation in the past. As well as creating acute threats to forest dependent biodiversity, the decline in global forests also has a series of direct social and economic costs because of the role of forests in supplying timber and many important nontimber forest products along with a wide range of environmental service such as the stabilisation of soils and climate. Forest loss and degradation has already led to the extinction of species, has altered hydrological regimes and damaged the livelihoods of millions of people—mainly amongst the poorest on the earth—who rely on forests for subsistence. In many areas, protecting and managing the remaining forests are no longer sufficient steps in themselves to ensure that forest functions are maintained, and restoration is already an essential third component of any management strategy.

Unfortunately, many existing restoration projects have partially or completely failed, often because the trees that they sought to establish have not survived or have been rapidly destroyed by the same pressures that have caused forest loss in the first place. Anyone working regularly in the tropics becomes accustomed to finding abandoned tree nurseries, often with their donor organisations' signboards still in place, the paint gradually peeling away. Even when crops of trees have survived to maturity, they have not necessarily been welcomed, as evidenced by the widespread controversy over afforestation with exotic monocultures of conifers in much of western Europe[4] and the increasingly bitter debates about tree plantations in the tropics.[5]

There has also often been a mismatch between social and ecological goals of conservation; either restoration has aimed to fulfil social or economic needs without reference to its wider ecological impacts, or it has had a narrow conservation aim without taking into account people's needs.

A number of consequent problems can be identified. Most restoration to date has been site-based, aiming to produce one or at most a limited number of goods and services. Projects have often sought to encourage and sometimes impose tree planting without understanding why trees disappeared in the first place and without attempting to address the immediate or underlying causes of forest loss.[6] Projects have also relied heavily on tree planting, which is often the most expensive way of reestablishing tree cover over a large area, frightening off governments, donors, and nongovernmental organisations. Because restoration takes time, it is essential to think and plan long term. Unfortunately, short-term political interests often supersede longer term priorities, creating simplistic approaches.

The above reservations are not to underestimate the major steps that have been made in understanding the ecological and social aspects of restoration, many of which are summarised in this book. Criticising after the event is always easy, and we also recognise the very real benefits that have accrued from successful restoration projects. Nonetheless, we are far from alone in believing that some new perspectives are needed in addressing the current restoration challenge. Perhaps the most important of these relates to working on a broader scale, along with all the implications that this has.

1.1. Taking a Broader Approach

An increasing number of governmental and nongovernmental conservation institutions have recognised that in order to achieve lasting conservation impacts it is necessary to work on a larger scale than has been the case in the past. Although there are a number of ways of defining useful ecological units for planning conservation, the concept of the *ecoregion* is increasingly being adopted, including by WWF, the global conservation organisation. An ecoregion is defined as a large area of land or water that contains a geographically distinct assemblage of natural communities that share a large majority of their species and ecological dynamics, share similar environmental conditions, and

[4] Tompkins, 1989.

[5] Carrere and Lohmann, 1996.

[6] Eckholm, 1979.

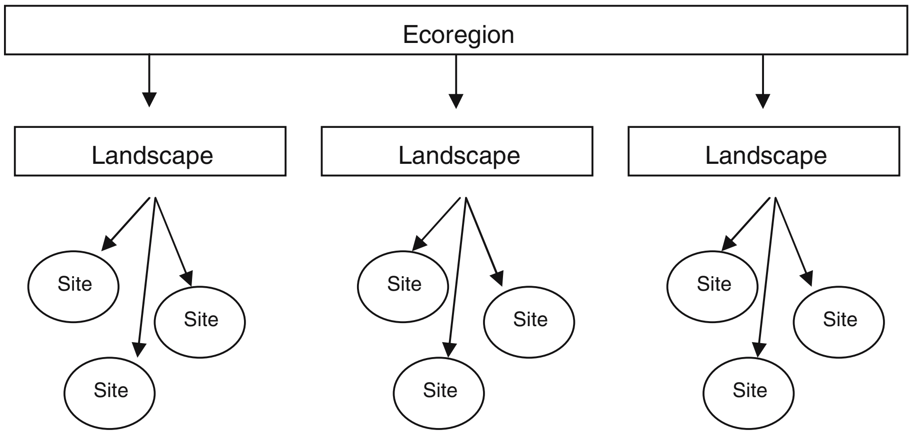

FIGURE 1.1. At the ecoregional scale, ecoregion visioning can help to identify a series of priority landscapes. At the landscape level, assessment and negotiation can help to identify agreed forest functions to be restored, leading to a number of actions at individual sites within the landscape. All these fit within the landscape goals for restoration, which themselves contribute to the ecoregion vision.

interact ecologically in ways that are critical for their long-term persistence. Ecoregions are suitable for broad-scale planning, which usually includes the identification of a few smaller priority landscapes that are particularly important from a conservation perspective, themselves composed of numerous sites with different management regimes or habitats (see chapter "Restoration as a Strategy to Contribute to Ecoregion Visions").

As used here (Fig. 1.1), landscapes are generally smaller than ecoregions, and typically a number of important "conservation landscapes" have been identified within ecoregions during planning processes. But the key point here is that landscapes are bigger than single sites and therefore almost always encompass a range of different management approaches.

Coming from a conservation organisation, this book is biased toward ecological and biodiversity issues. However, forests have social and economic functions as well, and restoration efforts often need to address many needs at once. This may not be possible within a single site; it is, for example, difficult to create a large harvest of industrial timber or firewood in an environment that is also suitable for specialised or sensitive wildlife species. One important reason for shifting the focus to a landscape scale is that it is hoped this can provide a broad-enough area to plan a suite of restoration activities that could meet multiple needs and to negotiate the compromises and trade-offs that such a mosaic entails. The aims of forest landscape restoration have therefore always transcended conservation to embrace development as well, and we have invited a number of experts to provide a parallel set of social tools and approaches within the current volume. We believe that successful restoration on a broad scale relies on getting the right mix between social and environmental needs; this is a fundamental part of the process and not an optional extra.

Accordingly, in 2000, WWF and IUCN, the World Conservation Union, brought together a range of experts from different organisations, different regions, and different disciplines to agree on a definition for forest landscape restoration[7]: "A planned process that aims to regain ecological integrity and enhance human well-being in deforested or degraded landscapes." This definition and approach lies at the heart of the current book. "Ecological integrity" is described by Parks Canada as a state of ecosystem development that is characteristic of its geographic location, containing a full range of native species and supportive processes that are present in viable numbers. "Well-being" embraces the factors that make

[7] WWF and IUCN, 2000.

human life comfortable, such as money, peace, health, stability, and equable governance.

1.2. What Is Special About Forest Restoration in a Landscape?

Restoring the complexity of a small patch of forests is in itself an achievement. However, a greater challenge lies in restoring a matrix of forests within larger areas—landscapes—to meet different needs. At this greater spatial scale, different influences, pressures, stakeholders, and habitats coexist, which in some ways increases the challenges of restoration. However, the landscape scale also provides enough space to plan and implement restoration to meet multiple needs.

Conservation priorities therefore must be balanced with other aspects of sustainable development. Specific uses and priorities may have to be focussed on part of the forest landscape, and the resulting trade-offs negotiated and agreed to by a wide range of stakeholders. The resulting task is generally too complex to be solved solely by site-based approaches focussing on a narrow range of benefits from individual forests. Achieving a balance between the various goods and services required from restored forest ecosystems requires conceptualisation, planning, and implementation on a broader scale.

It also requires deciding where forest is and is not needed. Aiming at restoring forest functions does not necessarily mean restoring forest across the whole landscape; this is often impossible in a crowded world with many competing claims on land. Rather, it entails identifying those areas where forests are most useful, from a variety of social and ecological perspectives, and further identifying what type of forest is likely to be most useful in a particular location. Whilst from a conservation perspective a high degree of naturalness is often important, this may not be the case for social or economic uses. Even in the parts of the landscape that are “specialised” in conservation, sometimes cultural landscapes are desired either because they have been in place for so long that remaining biodiversity has adapted to these conditions or because there is not sufficient space for a fully functioning natural system (for instance, with respect to the way that the forest changes and regenerates over time).

Forests managed for social needs may have different priorities. Sometimes these overlap with conservation requirements—for instance some forests managed for nontimber forest products can be extremely rich in biodiversity—in other cases they do not. Seeking a balance at a landscape scale is more important than trying to make sure that every scrap of forest fulfils every possible role. Broad-scale restoration in most cases, therefore, has to address multiple, sometimes competing, needs that will themselves entail different types of forests (perhaps ranging from natural forests to plantations) and sometimes also including quite specific requirements such as particular nontimber forest products required by local communities or maintenance of water quality in a certain watershed. Such *multifunctional landscapes* by their nature need to be planned and implemented on a far broader scale than an individual forest patch.

2. Conclusion

For foresters, restoration traditionally meant establishing trees for a number of functions (wood or pulp production, soil protection). For many conservationists restoration is either about restoring original forest cover in degraded areas or about planting corridors of forest to link protected areas. For many interested in social development, the emphasis will instead be on establishing trees that are useful for fuelwood, or fruits, or as windbreaks and livestock enclosures. The sad fact is that all too many restoration projects do not bother to find out what local people really want at all; if they do, then a collection of different and often opposing or mutually exclusive wants and desires emerge. There is still a lot to be learned and disseminated about reconciling nature and human needs, and about planning restoration areas within larger scales in order to return as wide a range of forest functions as possible. This requires the ability to work across disciplines, including agriculture, forest-compatible income-generation activities, forestry, and addressing water issues as well as specific social issues. It also, perhaps even more importantly, requires finding out how to bring the people most affected into the debate, not as a matter of duty or because funding agencies expect it but because this is vital and necessary for both nature and human well-being.

Through ecoregion conservation, WWF has learned that working on a large scale is complex, costly, and time-intensive; however, it is also a more sustainable way of addressing conservation than through small, often unrelated projects. This approach is also a challenge for restoration.

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2
Overview of Forest Restoration Strategies and Terms

Stephanie Mansourian

Confusion reigns as the term restoration is used indiscriminately, with no consensus even among practitioners in its meaning.

Stanturf and Madsen, 2002

Key Points to Retain

There are numerous terms promoting different strategies when dealing with forest restoration, which could be a source of confusion.

WWF is implementing forest landscape restoration (FLR) as an integral component of the conservation of large, biologically important areas such as ecoregions, along with protection and good management.

Forest landscape restoration is an approach to forest restoration that seeks to balance human needs with those of biodiversity, thus aiming to restore a range of forest functions and accepting and negotiating the trade-offs between them.

While the challenge of restoration on a large scale is greater than at individual sites, it is accepted nowadays that the effectiveness of forest restoration and its chances of sustainability are both much greater on a large scale.

Forest landscape restoration aims to achieve a landscape containing valuable forests, rather than returning forest cover across an entire landscape.

1. Background and Explanation of the Issue

When forests are lost or degraded, we lose far more than just the trees that they contain. Forests provide a large number of goods and services, including habitat for species, homeland for indigenous peoples, recreational areas, food, medicines, and environmental services such as soil stabilisation. And as forest areas are reduced, pressure on remaining forests increases.

Efforts at reversing this trend have had only limited success. For many, restoration signifies large-scale afforestation or reforestation (mainly using fast growing exotic species), which have only limited conservation benefits. This has been the approach taken by many governments that are seeking to support a timber industry or create jobs or, equally, those who have taken a simplistic approach to flood or other disaster mitigation. On the other hand, some have sought to re-create original forests, a near-impossible feat in areas where millennia of human intervention have modified the landscape and local conditions.

Many different terms are used to describe these different approaches and can result in some confusion or misconceptions.[8] We attempt here to cover most of the terminology used in English taken from the Society for Ecological Restoration International (SERI), which has

[8] Ormerod, 2003.

made the best attempt at cataloguing and defining these different terminologies and concepts. It must be noted that this complexity is also apparent and sometimes exacerbated when translating these terms into other languages.

2. Examples

We present below a number of terms that have been defined recently by SERI in its "The SER Primer on Ecological Restoration."[9]

2.1. Ecological Restoration

Ecological restoration is defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. It is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity, and sustainability.

Example 1: In 2000, in an attempt to re-create a native wild wood, the Scottish nongovernmental organisation (NGO), Borders Forest Trust, together with many partners, bought a 600-hectare plot of land, Carrifran, in the Southern Uplands of Scotland in order to restore its original forest. Thanks to fossil pollen buried deep in peat, it was possible to identify the nature of the variety of species previously found on this now near-denuded site and therefore to develop a restoration plan that aimed to re-create the species' mix that had occurred in the past. Thousands of native tree seeds from surviving woodland remnants in the vicinity were collected. A total of 103.13 hectares (165,008 trees) have been planted at Carrifran since the start of the project. The upper part of the site is being allowed to regenerate naturally.[10]

2.2. Rehabilitation

Rehabilitation emphasises the reparation of ecosystem processes, productivity, and services, whereas the goals of restoration also include the reestablishment of the preexisting biotic integrity in terms of species' composition and community structure.

Example 2: Bamburi Cement's quarries in Mombasa (Kenya) were once woodland expanses covering 1,200 hectares.[11] Starting in 1971, experiments began with the rehabilitation of the disused quarries. In the face of badly damaged soils, three tree species proved capable of withstanding the difficult growing conditions: *Casuarina equisetifolia, Conocarpus lancifolius*, and the coconut palm. The Casuarina is nitrogen fixing and is drought and salt tolerant, enabling it to colonise areas left virtually without soil. The Conocarpus is also a drought-, flood-, and salt-tolerant swamp tree. The decomposition of the Casuarina leaf litter was initially very slow due to a high protein content, thus impeding the nutrient cycling process, although this problem was overcome by introducing a local red-legged millipede that feeds on the dry leaves and starts the decomposition process. Today this area contains more than 200 coastal forest species and a famous nature trail, attracting 100,000 visitors a year since opening in 1984.

2.3. Reclamation

Reclamation is a term commonly used in the context of mined lands in North America and the United Kingdom. It has as its main objectives the stabilisation of the terrain, assurance of public safety, aesthetic improvement, and usually a return of the land to what, within the regional context, is considered to be a useful purpose.

Example 3: A large open-cut bauxite mine at Trombetas in Pará state in central Amazonia is located in an area of relatively undisturbed evergreen equatorial moist forest. A reclamation programme has been developed to restore the original forest cover as far as possible. The project has treated about 100 hectares of mined land per year for the last 15 years. First, the mined site was levelled and topsoil replaced to a depth of about 15 cm using topsoil from the site that was removed and stockpiled (for less

[9] SERI, 2002.
[10] www.carrifran.com.
[11] Baer, 1996.

than 6 months) prior to mining. Next, the site was deep-ripped to a depth of 90 cm (1-m spacing between rows). Trees were planted along alternate rip lines at 2-m spacings (2500 trees per hectare) using direct seeding, stumped saplings, or potted seedlings. Some 160 local tree species were tested for their suitability in the programme, and more than 70 species from the local natural forests are now routinely used. After 13 years most sites have many more tree and shrub species than those initially planted because of seeds stored in the topsoil or colonisation from the surrounding forest. Not surprisingly, the density of these new colonists is greater at sites near intact forest, but dispersal was evident up to 640 m away from old-growth forest. The new species, most of which have small seed, have been brought to the site by birds, bats, or terrestrial mammals.[12]

2.4. Afforestation/Reforestation

Afforestation and reforestation refer to the artificial establishment of trees, in the former case where no trees existed before. In addition, in the context of the U.N.'s Framework Convention on Climate Change (UNFCCC) and the Kyoto protocol, specific definitions have been agreed on reforestation and afforestation.[13] Afforestation is defined by the UNFCCC as "the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding, and/or human induced promotion of natural seed sources."

Example 4: During the middle years of the 20th century, very large areas of long-deforested land were planted in Scotland by the state forestry body, initially as a strategic resource. In contrast to the Borders Forest Trust project described above, these efforts made no attempt to re-create the original forest, instead using exotic monocultures, mainly of Sitka spruce from Alaska (*Picea sitchensis*) or Norway spruce (*Picea abies*) from mainland Europe. Planting was generally so dense that virtually no understorey plant species developed.

[12] Lamb and Gilmour, 2003.
[13] UNFCC, 2003.

Reforestation is defined by the UNFCCC as "the direct human-induced conversion of non-forested land to forested land through planting, seeding, and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land."

Example 5: In Madagascar, large plantation projects were planned in the early 1970s to supply a paper mill on the "Haut Mangoro." By 1990 about 80,000 hectares had been planted, 97 percent of which was *Pinus spp*. This project created significant social and political tensions, as the local population systematically opposed a project that it felt was not providing much benefit.[14]

2.5. What Is WWF's Definition?

In 2000 WWF and IUCN, the World Conservation Union, were asking the questions: What is meant by forest restoration? How can we achieve lasting and successful forest restoration in our ecoregional programmes? The two organisations felt that a suitable definition and typology of restoration were needed. In particular, given the large-scale conservation work that the organisations were engaging in, it was felt that there was still a gap in knowledge and in approaches to forest restoration. Notably, how does forest restoration relate to plantations, agroforestry, secondary forests, biological corridors, and single trees in the landscape?

In July 2000 WWF and IUCN brought together a number of regional conservation staff, foresters, economists, and other professionals to help them take restoration forward. They defined the term *forest landscape restoration* as "a planned process that aims to regain ecological integrity[15] and enhance human well-being[16] in deforested or degraded landscapes."

[14] Faralala, 2003.
[15] Ecological Integrity, for WWF and IUCN, is "maintaining the diversity and quality of ecosystems, and enhancing their capacity to adapt to change and provide for the needs of future generations."
[16] Human well-being, for WWF and IUCN, is "ensuring that all people have a role in shaping decisions that affect their ability to meet their needs, safeguard their livelihoods, and realise their full potential."

The key elements of FLR are as follows:

- It is implemented at a landscape scale rather than a single site—that is to say, planning for forest restoration is done in the context of other elements: social, economic, and biological, in the landscape. This does not necessarily imply planting trees across an entire landscape but rather strategically locating forests and woodlands in areas that are necessary to achieve an agreed set of functions (e.g., habitat for a specific species, soil stabilisation, provision of building materials for local communities).
- It has both a socioeconomic and an ecological dimension. People who have a stake in the state of the landscape are more likely to engage positively in its restoration.
- It implies addressing the root causes of forest loss and degradation. Restoration can sometimes be achieved simply by removing whatever caused the loss of forest, (such as perverse incentives and grazing animals). This also means that without removing the cause of forest loss and degradation, any restoration effort is likely to be in vain.
- It opts for a package of solutions. There is no single restoration technique that can be applied to all situations. In each case a number of elements need to be covered, but how to do that depends on the local conditions. The package may include practical techniques, such as agro-forestry, enrichment planting, and natural regeneration at a landscape scale, but also embraces policy analysis, training, and research.
- It involves a range of stakeholders in planning and decision making to achieve a solution that is acceptable and therefore sustainable. The decision of what to aim for in the long term when restoring a landscape should ideally be made through a process that includes representatives of different interest groups in the landscape in order to reach, if not a consensus, at least a compromise that is acceptable to all.
- It involves identifying and negotiating trade-offs. In relation to the above point, when a consensus cannot be reached, different interest groups need to negotiate and agree on what may seem like a less than optimal solution if taken from one perspective, but a solution that when taken from the whole group's perspective can be acceptable to all.
- It places the emphasis not only on forest quantity but also on forest quality. Decision makers often think predominantly about the area of trees to be planted when considering restoration, yet often improving the quality of existing forests can yield bigger benefits for a lower cost.
- It aims to restore a range of forest goods, services, and processes, rather than forest cover per se. It is not just the trees themselves that are important, but often all of the accompanying elements that go with healthy forests, such as nutrient cycling, soil stabilisation, medicinal and food plants, forest-dwelling animal species, etc. Including the full range of potential benefits in the planning process makes the choice of restoration technique, locations, and tree species much more focussed. It also allows more flexibility for discussions on trade-offs with different stakeholders, by providing a diversity of values rather than just one or two.

Forest landscape restoration goes beyond establishing forest cover per se. Its aim is to achieve a landscape containing valuable forests, for instance partly to provide timber, partly mixed with subsistence crops to raise yields and protect the soils, as well as partly improving biodiversity habitat and increasing the availability of subsistence goods. By balancing these within a landscape, WWF believes that it is possible to enhance the overall benefits to people and biodiversity at that scale.

3. Outline of Tools

Broad definitions and explanations of what restoration entails can be found in most conservation and forestry institutions. Nonetheless, little of this has reached the field. Because of its complexity, large-scale restoration requires a mixture of responses from practical to political and many practitioners are at a loss as to where to begin.

Some practical guidance is available:

- The Society for Ecological Restoration (SERI) have developed guidelines for restoration (see *Guidelines for Developing and Managing Ecological Restoration Projects*, 2000, at www.ser.org).
- The International Tropical Timber Organisation (ITTO) developed some guidelines[17]on the restoration, management, and rehabilitation of degraded and secondary tropical forests.
- The International Union of Forest Research Organisations (IUFRO) runs a special programme on correct usage of technical terms in forestry called SilvaVoc, available on its Web site: www.iufro.org/science/special/silvavoc/.
- The Nature Conservancy (TNC)[18] has identified some guidance on when and where to restore (see *Geography of Hope Update, When and Where to Consider Restoration in Ecoregional Planning* at www.conserveonline.org).
- In 2003, IUCN and WWF published a book, by David Lamb and Don Gilmour,[19] *Rehabilitation and Restoration of Degraded Forests*, which covers site-based techniques to restoration (summarised in a paper in this manual) but also highlights some of the gaps.
- Cambridge Press has produced a *Handbook of Ecological Restoration*,[20] which is a two-volume handbook containing a large amount of material on the diverse aspects of restoration.

It should also be noted that a number of state forest services and the U.S. Department of Agriculture have produced guidelines for planting trees. However, while these guidelines may have some applicability for very specific cases (issues dealing with one or another specific species), they are of limited value for restoration within ecoregions or large and biologically and structurally complex areas.

Tools available to address specific elements of restoration are summarised in other chapters of this manual.

[17] ITTO, 2002.
[18] TNC, 2002.
[19] Lamb and Gilmour, 2003.
[20] Perrow and Davy, 2002.

4. Future Needs

In the context of terminology related to restoration, given the flurry of interest, concepts, and definitions being touted, there is a need for

- a set of widely accepted definitions (such as those of SERI) to be used more systematically and rigorously;
- efforts and resources to be more focussed on the "doing" than on the "defining";
- greater exchanges, debates, and sharing of experiences in order to disseminate the accepted concepts and the positive experiences; and
- the accepted definitions in the restoration field to be shared with other relevant expert groups, such as development workers, foresters, extension officers, etc.

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Section II
The Challenging Context of Forest Restoration Today

3
Impact of Forest Loss and Degradation on Biodiversity

Nigel Dudley

Key Points to Retain

Assessment of current forest condition is a necessary precursor to restoration.

Ecological assessments should consider issues related to biodiversity, level of naturalness, and more generally ecological integrity.

A number of assessment tools exist, for national, landscape, and site-level assessments. They include: at national scale, frontier forests; at landscape scale, forest quality assessment; and a number of site-level tools including High Conservation Value Forest assessments.

1. Background and Explanation of the Issue

1.1. The Need for Assessment and Likely Impacts of Forest Loss

Assessment of forest condition is an important precursor to the planning and implementation of restoration programmes. Restoration is a process that in the case of forests generally aims at rebuilding the ecosystem to some earlier or more desirable stage. There is widespread recognition of the need for restoration; for example, in its Programme of Work on Protected Areas the Convention on Biological Diversity advises governments to "rehabilitate and restore habitats and degraded ecosystems, as appropriate, as a contribution to building ecological networks, ecological corridors and/or buffer zones." Given limited time and resources, restoration must be strategic, focussing on forests that have the highest importance to biodiversity or to society, and considering the four goals of conservation biology: representation, maintenance of evolutionary/ecological processes, maintenance of species, and conservation of large habitat blocks. Reasonably fine-scale analyses are needed to choose specific sites where restoration might bring the highest benefits. From a conservation perspective, this means evaluating the impacts of forest loss, including analysis of biodiversity, authenticity, and ecological integrity.

Impacts on biodiversity: Complete forest loss has the clearest impact on biodiversity, with most forest-dwelling species unable to live in habitats that replace forests. However, it is harder to measure the impacts of changes such as fragmentation and loss of microhabitats. Management often simplifies forests, reducing biodiversity and age range; as older and dead trees disappear, so do many associated species. Conversely, pioneer or weed species may increase. Biodiversity monitoring is costly, and our knowledge of many forest ecosystems is still incomplete. One concept that has gained increasing recognition in the last few years is that of *critical thresholds* for particular species, that is, the population level below which further decline and eventual extirpation or extinction is likely, and where these thresholds are known they can play a key role in monitoring impacts and planning restoration strategies.

Impacts on authenticity or naturalness: On an ecosystem scale, measuring impacts on overall naturalness of forests is easier than surveying biodiversity and acts as a partial surrogate; generally the greater the naturalness of a forest, the more of its original constituent species are likely to survive. Worldwide forest authenticity is declining fast. In most West European countries less than 1 percent of forests are classified by the United Nations as "undisturbed."[21] A growing proportion of forests in Africa, the Pacific, and the Amazon have been logged at least once.

Ecological integrity: This concept covers many of the above issues. It is defined by Parks Canada as "a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change, and supporting processes."[22]

Evaluation of options for restoration should also consider the reasons why forest loss or degradation have occurred. Many restoration programmes fail because the pressures that caused deforestation are not addressed, and restored forests suffer the same fate as the original forests. If population or economic pressures mean that there is insufficient fuelwood, then planted trees will be burned long before they have a chance to mature and reach a useful size. On the other hand, understanding the nature of the pressures and working with local communities to plan restoration in ways that are mutually beneficial increases the chances of restoration succeeding. Assessment needs to address several different aspects:

- Impacts of forest loss and degradation on biodiversity, naturalness, and ecological integrity;
- Some of the key factors causing change;
- Changes in biodiversity, naturalness, and ecological integrity following restoration interventions.

Whilst the first two can be assessed through single surveys, assessment of trends implies the need for a monitoring system.

2. Examples

2.1. New Caledonia

In New Caledonia the overall loss of forests creates a critical threat to biodiversity and ecological integrity. Today only 2 percent of the dry forest remains in the island, in scattered fragments of 300 hectares or less, leading to extreme threats to the remaining biodiversity. Over half of the 117 dry forest plant species assessed by the IUCN Species Survival Commission are threatened, and it is likely that several have already gone extinct. For example, the tree *Pittosporum tanianum* was discovered in 1988 on Leprédour Island in an area that has been devastated by introduced rabbits and deer, declared extinct in 1994, and rediscovered in 2002. This level of damage suggests an urgent need for both restoration of forest cover and a carefully designed series of interventions to protect and allow the spread of species that may already be at critically low levels.[23]

2.2. Western Europe

Changes in management and human disturbance have reduced near-natural forests to less than 1 percent of their original area in most western European countries, despite an expanding forest estate. In Europe as a whole, almost nine million hectares are defined as "undisturbed by man," but most of this exists in the Russian Federation and Scandinavia; Sweden records 16 percent of its forest as natural, Finland 5 percent, and Norway 2 percent. In most of Europe the proportion is usually from zero to less than 1 percent; for instance, Switzerland records 0.6 percent.[24] Even in forest-rich countries like Finland and Sweden, many forestd-welling species are threatened because the forests contain only a proportion of the

[21] UNECE and FAO, 2000.
[22] Parks Canada, undated.
[23] Vallauri and Géraux, 2004.
[24] UNECE and FAO, 2000.

expected habitats and ecosystem functions. Here the challenge is less to recover forest area (although this may sometimes be important) than to restore natural ecosystem processes and microhabitats. Specific monitoring criteria are needed and these have started to be developed, for instance by the Ministerial Conference on the Protection of Forests in Europe.[25]

2.3. Brazilian Atlantic Forests

In the Atlantic forest of Brazil, forest loss and fragmentation are combining to threaten endemic species. Although international attention tends to focus on threats to the Amazon, the Atlantic forests of Brazil have undergone far more dramatic losses. The forests have already been reduced to just 7 percent of their original size, and the associated threats to biodiversity are increased because the remaining areas are fragmented and the populations are genetically isolated. The area is home to many endemic species, including some of the 19 resident primates and 92 percent of amphibian species found there. Attention has focussed particularly on the golden lion tamarins (*Leontopithecus rosalia*), which now inhabit less than 2 percent of their original range. Their population is currently around 1000, up from little more than 200 twenty years ago following a major conservation effort. However, population is still believed to be below long-term viability, and subpopulations are isolated in remaining forest fragments. Restoration efforts, therefore, focus particularly in reconnecting the remaining forest fragments of high biological importance.

2.4. Uganda

In Uganda loss of connectivity is separating populations of mountain gorillas even in areas with relatively high forest cover. The world's remaining mountain gorillas (*Gorilla beringei beringei*) live in isolated rain forests in the mountains on the borders of Uganda, Rwanda, and the Democratic Republic of Congo, with half of the world's known population, 350 individuals, in Bwindi Impenetrable Forest Reserve in Uganda. Another major population is in the Virunga volcanoes area, some of which is in Mgahinga National Park. Neither of these populations is considered large enough to be genetically secure over time, but both reserves are also thought to be reaching their natural carrying capacity. Linking the two populations is important for their long-term survival, but the intervening land has all been converted to agriculture, and any restoration efforts will need a long period of planning and negotiation (information from park staff in Bwindi).

Understanding of what has been lost, and what is at risk of being lost, should be the basis for any forest restoration that has biodiversity conservation amongst its aims. This needs to be augmented with an understanding of what type or quality of forest is needed to maintain biodiversity. If the key issue is connectivity for large mammals and birds, for example, managed secondary forests or even plantations or shade-grown coffee may be suitable. If the threats are more generally to forest biodiversity, restoration efforts should probably be aimed at creating a forest as near to natural as possible.

3. Outline of Tools

Detailed biodiversity surveys are expensive and rely on a high level of expertise. Methodologies for achieving these have become increasingly sophisticated, and a number of short cuts have been developed where time and money are limited.

3.1. National Level Surveys

National level surveys can help identify the scale of the problems and the locations of valuable remaining forest habitat, which should usually serve as the starting point for restoration efforts. The U.N. Economic Commission for Europe and the Food and Agriculture Organisation asked countries to report on the proportion of their forest that was "undisturbed by man," taken here to mean left without management interventions for at least 200 years. This has created a fairly crude but effective

[25] Ministerial Conference on the Protection of Forests in Europe, 2002.

international database for many of the temperate countries, but as yet no similar exercise has been attempted in the tropics. It also does not create a very useful way of measuring progress in restoration. Some individual countries (e.g., Austria, France, and the U.K.) have also carried out detailed surveys of ancient forest.

3.2. High Conservation Value Forests (HCVF)

This is a WWF/ProForest methodology for identifying the forests of the highest conservation and social value in a landscape, drawing on six different types of HCVF: (1) forest areas containing globally, regionally, or nationally significant concentrations of biodiversity values (e.g., endemism, endangered species, refugia); (2) forest areas containing globally, regionally, or nationally significant large landscape level forests, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance; (3) forest areas that are in or contain rare, threatened, or endangered ecosystems; (4) forest areas that provide basic services of nature in critical situations; (5) forest areas fundamental to meeting basic needs of local communities; and (6) forest areas critical to local communities' traditional cultural identity.[26] Although designed initially for site-level assessments, a landscape-scale methodology is being developed.

3.3. Forest Quality Assessment

WWF and IUCN have developed an approach to landscape assessment of forest quality using indicators to map social and ecological values, including identifying different elements of naturalness or authenticity, drawing on the following: composition, pattern, ecological functioning, process, resilience, and area (also see "Restoring Quality in Existing Native Forest Landscapes"). Assessment is based on a seven-stage process: identification of aims, selection of the landscape, selection of a toolkit (relevant indicators), collection of information about each indicator, assessment, presentation of results, and incorporation into management. Information is collected through primary research, literature review, and interviews. The extent to which assessment is a participatory process can change depending on the situation and aims.[27]

3.4. Frontier Forest Analysis

Frontier forest analysis is a World Resources Institute/Global Forest Watch approach[28] that defines frontier forests as free from substantial anthropogenic fragmentation (settlements, roads, clearcuts, pipelines, power lines, mines, etc.); free from detectable human influence for periods that are long enough to ensure that it is formed by naturally occurring ecological processes (including fires, wind, and pest species); large enough to be resilient to edge effects and to survive most natural disturbance events; containing only naturally seeded indigenous plant species; and supporting viable populations of most native species associated with the ecosystem.[29] It is mainly used at a national scale.

3.5. Site-Scale Survey Methods

A wide range of survey methods exist including some that have specifically been developed to facilitate rapid surveys for conservation practitioners, amongst these are the Rapid Ecological Assessment methodology developed by The Nature Conservancy.[30] Increasingly surveys by outside experts are being augmented by interviews and collaboration with local communities, which often have great understanding of population levels of key plants and animals; these sources are usually referred to as traditional ecological knowledge.

4. Future Needs

Despite expertise in survey methods, there is still much to be learned about accurate ways

[26] Jennings et al, 2003.

[27] Dudley et al, in press.

[28] Bryant et al, 1997.

[29] Smith et al, 2000.

[30] Sayre et al, 2002.

of monitoring of both biodiversity and, more critically, ecological integrity that would allow proper assessment of restoration outcomes over time and thus help set realistic goals for restoration. In general, quick and cost-effective methods of monitoring the impacts of restoration on biodiversity and ecology are still required in many ecosystems.

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4
The Impacts of Degradation and Forest Loss on Human Well-Being and Its Social and Political Relevance for Restoration

Mary Hobley

Forests: "the poor man's overcoat" (Westoby, 1989).

Forests have an important role to play in alleviating poverty worldwide in two senses. First, they serve a vital safety net function, helping rural people avoid poverty, or helping those who are poor to mitigate their plight. Second, forests have untapped potential to actually lift some rural people out of poverty (Sunderlin et al, 2004).

Key Points to Retain

Poor people rely on forests as a safety net to avoid or mitigate poverty and sometimes as a way to lift themselves out of poverty.

It is important to recognise different levels of poverty and different types of dependence on forests when trying to understand the likely social implications of forest restoration.

A series of tools and questions exist that can help to identify potential benefits from restoration, although these need to be used with care to avoid overlooking some of the poorest members of society.

1. Background and Explanation of the Issue

For many millions of people forests and forest products and services supply both direct and indirect sources of livelihood, providing a major part of their physical, material, economic, and spiritual lives[31]). The World Bank has estimated that 90 percent of the world's 1.2 billion poorest people depend on forests in some way or another. Forest areas often coincide with areas of high poverty incidence and livelihood dependence on forests. They often occur in remote rural areas with poor infrastructure and limited access to markets and other basic services; the livelihood options in such areas are highly circumscribed. The challenge facing many communities is not just the restoration of trees in their landscape but the growth of a political and social landscape that facilitates their ability to make choices to secure their livelihoods.

In this section we consider the impacts of forest loss and degradation on human well-being. At the most simple level the first question must be: impact on whom? This is an important point because degradation and loss of resources affects people in different ways. To explore this question we need to unpick the concept of well-being and then look at the ways in which forests and people are intertwined. The major focus of this section, however, is on those who are most adversely affected by changes in forest cover and quality—the poor, and in particular those living in forest areas. The second question to ask is why deforestation and degradation happen, since understanding the

[31] Byron and Arnold, 1997.

answers to this question provides answers to whom it impacts on. As part of this process we need to set out the major concepts and terms that support this understanding. These are *deforestation* and *degradation*, *well-being*, *livelihoods*, *people*, and *impact*.

The drivers of forest loss and degradation are complex and variable, moving from the extreme of deforestation for other land uses to more subtle forms of degradation through multiple overuse, either happening slowly or more rapidly depending on the pressures driving change. Who drives the changes in the forests and who benefits from them also helps to determine the impacts. These are not simple events and do not have simple causal consequences. For example, one person's loss as a result of forest degradation may be another person's gain if for instance opportunities to farm land are opened up. Timber companies benefit from timber extraction but generally the capture of benefits at the local level is very weak and the local social and environmental costs of logging are high.

Following Wunder[32] and the U.N. Food and Agricultural Organisation, *deforestation* (or forest loss) is defined as a radical removal of vegetation to less than 10 percent crown cover. For local people deforestation can be catastrophic, as in the case of large-scale clear-felling by an outside agency that destroys resources without offering any alternatives, or in other cases it can be the planned precursor to an alternative land use system such as farming, which in terms of livelihood outcomes may provide more secure alternatives than that offered by the forest.

Degradation is taken to mean a loss of forest structure, productivity, and native species' diversity. A degraded site may still contain trees or forest but it will have lost its former ecological integrity.[33] Degradation is a process of loss of forest quality that is in practice often part of the chain of events that eventually leads to deforestation.

Impact: "Impact concerns the long-term and sustainable changes introduced by a given intervention in the lives of beneficiaries. Impact can be related either to the specific objectives of an intervention or to unanticipated changes caused by an intervention; such unanticipated changes may also occur in the lives of people not belonging to the beneficiary group. Impact can be either positive or negative, the latter being equally important to be aware of."[34]

Well-being is a concept used to describe all elements of how individuals experience the world and their capacities to interact, and includes the degree of access to material income or consumption, levels of education and health, vulnerability and exposure to risk, opportunity to be heard, and ability to exercise power, particularly over decisions relating to securing livelihoods.[35] When used in connection with livelihoods it becomes a powerful concept for considering the effects of change on all aspects of the lived experience of an individual.

A useful definition of *livelihoods* is as follows: "People's capacity to generate and maintain their means of living, enhance their well-being and that of future generations. These capacities are contingent upon the availability and accessibility of options which are ecological, economic, and political and which are predicated on equity, ownership of resources, and participatory decision making."[36]

The individual experience of well-being varies along a continuum, with ill-being at one end and well-being at the other, and is not static; it can vary during an individual's life cycle. Those classified as extreme poor often suffer ill-being, particularly expressed through high degrees of exposure to vulnerability and risk, whereas those who can be classified as improving poor generally experience higher levels of well-being. It is important to be able to differentiate among people's vulnerabilities in order to understand the differential effects that forest loss and degradation may have.

One of the most important issues to consider when looking at the effects of a change in access to or availability of forest products and services is a household's exposure to vulnera-

[32] Wunder, 2001.
[33] Lamb and Gilmour, 2003: 4.
[34] Blankenberg, 1995.
[35] World Bank, 2001:15.
[36] de Satgé, 2002:4.

bility and risk. It is clear that households and individuals within households experience different levels of vulnerability and exposure to risk. This is particularly important in the assessment of the effects of forest quality change, as it has differential impacts within and between households.

There are two main ways in which forests impact on livelihoods and reduce vulnerability:

- as a *safety net* helping rural people avoid poverty and helping those who are poor to mitigate their poverty;
- through their potential to lift some people out of poverty.

For the sake of understanding the likely impacts of forest loss or restoration, it is useful to define *people* in terms of their vulnerability and their relationships with forests and forest products (see Table 4.1 for examples of impacts of degradation and deforestation on these different groups):

- Extreme poor with very little or no capability for social mobilisation
- Coping poor with little capability for social mobilisation
- Improving poor with some capability for social mobilisation

This typology helps to underline the importance of understanding the social situation of households and individuals. Attempts to address restoration in a social context, without recognising the differences that degrees of poverty have on people's relative vulnerability and opportunities, most often at best ignore those in extreme poverty and at worst exacerbate their condition.

Also important in this context are the different relationships that people have with forests which can usefully be categorised as[37]:

- hunters and gatherers,
- shifting cultivators,
- farming communities with inputs from the forest, and
- livelihoods based on commercial forest product activities.

Poverty is not a uniform experience for these four types of forest-related people, and neither is it possible to say, for example, that all shifting cultivators are extremely poor or that all farming communities are "improving poor." This makes it even more difficult to generalise about the impacts that forest change will have on individual livelihoods. Within the same community, dependence on forests and wildlands will vary, although generally the extremely poor will be the most dependent on the resources from natural habitats and the improving poor will be less dependent. However, those whose livelihoods are most interlinked with the forest resource, such as hunter-gatherer groups and shifting cultivators, are those who are the most vulnerable to any changes in that resource and are also the least able to move into other livelihood options.

It should be noted that these are by no means static categories; they change as the local and national environment changes. For example, increasing market penetration has profound effects on the choices or enforced changes that people have to make in their livelihood base. The key point to recognise here is the diversity of the types of relationships that people have with forests and therefore the diversity of impacts that changes in forests and associated landscapes might have on the livelihoods of those living in and around them.

1.1. Relationships to the Forest

It is also important to move away from a broad-brush consideration of communities to recognition of differences between individual households and categories of well-being.[38] Many people assume that communities have common interests or, where they are conflicting, that disagreements could be resolved by working with the different interest groups, but this is not always the case. This becomes particularly important when considering the impacts of changes in forest cover and quality and how this is experienced by different households. For some of the most dependent people,

[37] Byron and Arnold, 1997.

[38] de Satgé, 2002.

TABLE 4.1. Examples of impacts of deforestation and degradation.

		Impacts on people		
Process	Product	Extreme poor	Coping poor	Improving poor
Deforestation	Conversion of forests to agriculture	Lose access to forest resources Will not obtain land for agriculture as generally do not have the power to acquire the land May be labourers for others but generally too marginalised	Lose access to safety net functions of forest resources May become labourers for others on converted forest land	Lose access to safety net functions of forest resources; may acquire land under clearance as have better access to influence local decision making
Degradation	Foods: variety to diets, palatability, meet seasonal dietary shortfalls, snack food, emergency foods during flood, famine, war, etc. Fuels: firewood, charcoal growing importance for urban as well as rural energy needs Medicines: range of traditional plant medicines essential to those in remote rural areas distant from other medical services	Diminishing access to foods, fuels, and medicines make their livelihoods even more insecure and more vulnerable to hazards; in areas of high forest cover this group in particular is highly forest resource dependent and most particularly affected by changes in access or reduction in quality of forest; this range of products needs little or no capital investment and is therefore more readily accessible to the extreme poor	The importance of this range of products to the coping poor is two fold: (1) as a safety net, and (2) as an income earner to contributing household economies; for women, these are often the only source of income that they are allowed to access and so although a small proportion of overall household income, they are of high gender significance	With a more diverse livelihood portfolio with more assets and opportunities for diversifying, this group is not so vulnerable to changes in forest condition; it is more able to access alternatives to the forest products; nonetheless, its need for the safety net functions of the forest remains, and without it these households could become more vulnerable and less resilient to shocks
	Timber	Reduced access to timber usually has little impact on this group because they have little power to control access to high value resources; benefits of timber are mostly captured by the elites often in urban centres	This group, as for the extreme poor, is unlikely to benefit in any direct way from the economic benefits of timber harvesting; although because of their better social networks and levels of well-being they may have more opportunity to be labourers for timber contractors	With greater ability to take risk and invest in some relatively low-cost technology such as chain saws, this group can access some limited benefits from timber harvesting; being better socially networked, this group is more likely to be engaged as timber harvesters
	Environmental services	Across all groups the environmental functions of forests are important for maintaining water supplies, inputs to agricultural productivity through improving soil fertility, and providing the range of biodiversity necessary to maintain a robust local ecosystem Degradation of environmental services is again most acutely felt by those who have no other options		For this group their more diverse portfolio and higher levels of risk-taking capacity means that they are more resilient to minor changes in environmental services.

Adapted from work by Brocklesby (2004) and Hobley (2004) differentiating between forms of poverty dependent on vulnerability and capability to have a voice.

forest change can be devastating, whereas for others with a broader livelihood portfolio that includes only limited dependence on the forests, changes in forest quality and extent may only have relatively minor effects. In such cases, responses to forest restoration will also be different between individual households in a community. The importance of a broad-based and carefully structured participatory process, linked to social mobilisation and including attempts to build the capacity of different social groups to have a voice, cannot be underestimated.

For some of the poorest rural peoples there is extreme forest dependence, but for others who are not so poor (the "coping" poor), the use of forests is indirect and more often is a means of poverty prevention, providing important seasonal safety nets. This latter role is often transitory as poor people build other assets to move out of poverty. It is rarely the case that forests themselves are the means to poverty reduction. However, what happens to the forests, their products and services, does have a profound impact on people's livelihoods, particularly when this is linked with the effects on other land uses such as grazing and agriculture.

Risk and uncertainty are universal characteristics of life in rural areas. Sources of risk include natural hazards like drought and flood, commodity price fluctuations, illness and death, changing social relationships, unstable governments, and armed conflicts. Some risky events like drought or flood simultaneously affect many households in a community or region. Other risky events, like illnesses, are household-specific and again have differential effects depending on the overall robustness of a particular household and its livelihood strategies. Catastrophic forest loss, for example through fire or clear-felling, thus affects whole communities, but the intensity of the effects are not necessarily uniform.

It is not only total forest loss that leads to negative impacts on well-being. For example, loss of particular nontimber forest products (NTFPs) from a surviving forest can be equally catastrophic to those households who have based their livelihoods around the use and sale of these products. Changes in market conditions, including in particular the recognition of the value of an NTFP on national and international markets, can disadvantage the very poor as the elites seize control of valuable natural resources and dominate market access.

1.2. Implications of Differential Social Impacts for Forest Restoration

1.2.1. Guiding Questions for Restoration

Forests can affect livelihoods in two principal ways that must be considered when any landscape restoration is under consideration[39]:

- Poverty avoidance or mitigation, that is, where forest resources serve a safety net function, or as a gap filler, including as a source of petty cash
- Poverty elimination, that is, where forest resources help lift a household out of poverty by functioning as a source of savings, investment, accumulation, asset building, and permanent increases in wealth and income

When restoration is planned to ameliorate the impacts of forest changes on the well-being of target groups a set of questions can help to guide responses as to the nature and extent of restoration required.[40] The usefulness of such questions depends to a large extent on the way in which they are asked. It is important to use participatory processes that lead to people being able to influence decisions about land use and control the outcomes of these decisions, but processes must also allow space for the voices of the extreme poor to be heard as well as those of the more articulate and much less vulnerable poor and wealthier groups:

What is the frequency or timing of use of forest products and the extent to which a household's labour is allocated to these activities?

What is the role of forest products in household livelihood systems? What is their importance as a share of household inputs, and in

[39] Sunderlin et al, 2004:1.

[40] Byron and Arnold, 1997.

meeting household livelihood strategy objectives?

What is the impact of reduced access to forests? Does the forest serve as a (critical) economic and ecological buffer for its users, or are there alternatives, such as trees outside forests or non–forest/tree sources of needed inputs and income?

What is the likely future importance of forest products? Do users face a growing or declining demand for forest products, or the potential for expanded or decreased involvement in production and trade in forest products?

2. Examples

Undoubtedly forest degradation and loss has major livelihood and well-being impacts for many people, from those with secure livelihoods to the extreme poor. It is therefore particularly important to understand the differential effects of forest change and the implications for livelihoods and livelihood options.

Byron and Arnold[41] provide a useful categorisation that aids this understanding and directs practical intervention. Clearly there is no general solution that can be applied across all situations. Any support to forest landscape restoration must be based on a careful assessment that "covers the range of the relationships between the people and the forests which they use and/or manage, the current limitations to their livelihoods, and the potentials and desires for change." They outline five generalised (and potentially overlapping) situations:

1. *Forests continue to be central to livelihood systems*. Local people are or should be the principal stakeholders in these forest areas. Meeting their needs is likely to be the principal objective of forest management and restoration, and this should be reflected in control and tenure arrangements (also see "Land Ownership and Forest Restoration").

2. *Forest products play an important supplementary and safety net role*. Users need security of access to the resources from which they source these products, but are often not the only users in that forest area. Forest management and control is likely to be best based on resource-sharing arrangements among several stakeholder groups. Successful restoration activities need to recognise and be planned with respect to these roles. Examples across the world include joint forest management in India and collaborative management in Ghana, where the state and local forest users share both in management decisions and in the benefits of forest products, which provide incentives to both partners to manage the forests for a range of benefits. However, in many cases the state is still reluctant to allow these agreements to cover high value forests, retaining control and access to the benefits and restricting local access to the forests and its products.[42] Community forestry in the hills of Nepal is widely cited as a successful example of transfer of control of management and benefits to local communities; again, however, the government has demonstrated its reluctance to extend management authority to the high value forests of the lowlands.

3. *Forest products play an important role but are more effectively supplied from nonforest sources*. Management of a proportion of the forests needs to be geared towards agro-forest structures, and control and tenure need to be consistent with the individual rather than the collective forms of governance that this shift is likely to require. Examples of these situations abound: PASOLAC (Programa para la Agricultura Sostenible en las Laderas de América Central) in Central America has been working with communities living in areas of high environmental degradation and insecurity to reduce their vulnerability to extreme natural events. This programme supports farmers to identify their own training requirements, provides financial and in-kind compensation for the management and maintenance of natural resources and their services and works to develop the integration of farmers and forest products into local markets. This integrated

[41] Byron and Arnold, 1997.

[42] Arnold, 2001; Molnar et al, 2004.

approach "combining improvements in human and social capital with advances in locally adapted resource management techniques and the creation of financial instruments"[43] is an important combination and an interesting progression away from approaches that have generally limited their support to more technically based interventions.

4. *Participants need help in exploiting opportunities to increase the benefits they obtain from forest product activities*. Constraints in the way of smallholders' access to markets need to be removed. Improved access to credit, skills, marketing services etc., may be required. A good example of the increasing experience with this type of support is provided by the PROCYMAF project (Proyecto de Conservación y Manejo Sostenible de Recursos Forestales) in Mexico. It has focussed on strengthening producer organisations and overcoming value chain "gaps."[44] This support is packaged with the supply of business services, which develop the skills of producer organisation leaders and members. A range of other programmes across the world are focussing on the better harvesting and marketing of a wide variety of NTFPs through understanding value chains and developing producer skills at entering markets in a more informed and secure environment.

5. *Participants need help in moving out of dead-end forest product activities*. An important example of this is firewood collection for sale in the market, often conducted by women who say they would rather be employed in other easier activities that are not so physically burdensome and poorly paid. It is often an activity of last resort and does not lead to opportunity to move out of these poverty confining conditions.

3. Outline of Tools

Baseline assessment: To build understanding of people's livelihoods and well-being, exposure to risk, and vulnerability, there are a range of tools that have been gathered under the umbrella of livelihoods analysis. These include survey methodologies and participatory appraisal approaches and are discussed in other chapters in this book. A useful guide to the range of tools and their applications can be found on Web sites including www.livelihoods.org. With this baseline assessment, it is then possible to begin to work with local people to identify different approaches to support their relationships with forests and forest products. It can be used as the basis for implementation and for later evaluation to assess the degree of change in exposure to risk and reduction in vulnerability as a result of livelihood interventions.

Tools for engagement: Voice, as has already been discussed, is an essential element of changing relationships and shifting power. Building poor people's capabilities to be able to influence decisions and policy is a key part of any restoration effort. Participatory tools and social mobilisation approaches are all used to build people's capabilities, but often voice is most strongly developed as poor people's livelihoods become more secure.

Community-based cost-benefit analysis: For communities, changing their use of forests and forest lands depends very much on individual and collective cost-benefit analyses. Communities are likely to be prepared to manage forests only if they offer greater benefit than under other uses of the land on which the forests grow. Such analyses are an essential part of any landscape restoration initiative because unless these costs and benefits are understood and factored into the process, initiatives will fail where perceived costs of maintaining the forest outweigh the tentative benefits. This is where ecosystem service payment schemes become an important part of the analysis and where it will be important to change local incentives and attitudes toward forests.[45] Additionally, focus on market access is critical where poor access and low values for forest products act as major barriers and disincentives.

[43] IISD et al, 2003.

[44] Scherr et al, 2003.

[45] Arnold, 2001.

Facilitating access to green markets: Providing mechanisms and funds that allow local people to access markets for ecosystem services such as watershed protection, biodiversity protection, etc., is another important element of changing the relationship between people's livelihoods and the forest resource. Forest certification can also be used to help forest managers to access higher value markets. There are some successful experiences with community-based certification in Latin America,[46] although the certification costs are often very high for small community groups and much more still needs to be done to provide standards that facilitate access of community managed natural timber into the green markets.

Securing tenure and management rights: Clearly tenure or at least long-term management rights are important elements in any forest restoration effort. There are now many models of communities that own forests with evidence of the incentives this creates for wise management. Tenure is often highly contested and requires careful work with governments to build an environment in which it is possible to shift tenure patterns. Often this requires significant evidence that changing tenure arrangements does lead to fundamental environmental and social benefits.

4. Future Needs

In any process of restoration, and perhaps particularly restoration projects driven by conservation concerns, some key messages need to be incorporated into the planning and implementation of any programme:

- Recognition of the differential importance of forests, products, and services on different people and therefore the differential impacts of changes in forest quality and extent;
- Recognition of the role of forests in poverty prevention as well as poverty reduction;
- The need to involve people in the decision-making process to build voice and capacity to articulate voice in an institutional and political environment that is able to respond to these voices;
- Recognition of the need to support the building of livelihoods that reduce people's exposure to risk and remove vulnerabilities;
- Recognition that forests alone do not necessarily move people out of poverty but actually can secure them in poverty;
- Support to decentralised service provision that can be socially responsive and tailored to particular ecological and economic conditions[47];
- Impacts of restoration also need to be carefully considered. Just as the impacts of degradation are not equally felt across livelihood groups, it is the case with restoration. Restoration of forest cover for some may have negative livelihood implications. Often the beneficiaries of restoration are not those living locally to the forest but are downstream users of services, therefore, the distribution of costs and benefits of restoration need to be carefully considered.

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5 Restoring Forest Landscapes in the Face of Climate Change

Jennifer Biringer and Lara J. Hansen

Key Points to Retain

Climate change increases the need for restoration, both to help forest systems to manage existing changes and to buffer them against likely changes in the future by increasing areas of natural, healthy forest systems.

Care needs to be taken to avoid oversimplistic reliance on forests for carbon sequestration, and attempts at restoration to increase carbon storage must be assessed carefully to judge their true worth.

Tools such as vulnerability analyses can help to design effective restoration strategies, which are likely to include reduction of fragmentation, increasing connectivity, development of effective buffer zones, and maintenance of genetic diversity.

1. Background and Explanation of the Issue

Climate change is arguably the greatest contemporary threat to biodiversity. It is already affecting ecosystems of all kinds and these impacts are expected to become more dramatic as the climate continues to change due to anthropogenic greenhouse gas emissions into the atmosphere, mostly from fossil fuel combustion. While restoration is made more difficult by climate change, it can conversely be seen as a possible adaptive management approach for enhancing the resilience of ecosystems to these changes.

Climate change will result in added physical and biological stresses to forest ecosystems, including drought, heat, increased evapotranspiration, altered seasonality of hydrology, pests, disease, and competition; the strength and type of effect will depend on the location. Such stresses will compound existing nonclimatic threats to forest biodiversity, including overharvesting, invasive species, pollution, and land conversion. This will result in forest ecosystems changing in composition and location. Therefore, in order to increase the potential for success, it will be necessary to consider these changes when designing restoration projects.

On the other hand, restoration projects can also be viewed as a key aspect of enhancing ecosystem resilience to climate change. Human development has resulted in habitat loss, fragmentation, and degradation. A first step in increasing resilience to the effects of climate change is enhancing or protecting the ecosystem's natural ability to respond to stress and change. Research suggests that this is best achieved with "healthy" and intact systems as a starting point, which can draw on their own internal diversity to have natural adaptation or acclimation potential,[48] and therefore greater resilience. Any restoration activities that enhance the ecological health of a system can

[48] Kumaraguru and Beamish, 1981; McLusky et al, 1986.

thus be seen as creating or increasing the potential buffering capacity against negative impacts of climate change. It should be mentioned that there are obvious limits to the rate and extent of change that even a robust system can tolerate. As a result it is only prudent to conduct restoration for enhancing resilience in tandem with efforts to reduce greenhouse gas emissions, the root cause of climate change.

For many with a forestry background, carbon dioxide sequestration might seem a concomitant advantage to restoration projects, which can aid in reduction of atmospheric concentrations of greenhouse gases. While forests do hold carbon, and their loss does release carbon, their long-term capacity to act as a reliable sink in the face of climate change, especially for effective mitigation, is not a foolproof strategy (for more on carbon sequestration projects, see "Carbon Knowledge Projects and Forest Landscape Restoration"). Where restoration is promoted with a focus on capturing carbon, an analysis of climate change impacts should be integrated into project planning to determine whether there really are net sequestration benefits. Increased incidence of forest fires as a result of warming and drying trends, for example, could outweigh any efforts to reduce carbon emissions. Case studies of successful resilience-building efforts are not yet plentiful, due to relatively recent revelations about the scale and impact that climate change will have on ecosystems. However, the global temperature has risen 0.7°C as atmospheric concentrations have risen[49] and extinctions and large-scale ecosystem changes are expected. A number of forest types are already being negatively impacted, including tropical montane cloud forests, dry forests, and forests in the boreal zone, and climate-related extinctions are already thought to have occurred, for example amongst amphibians. Along the coasts, the rising sea level is increasing the vulnerability of mangroves. Restoration as a means to ensure healthy ecosystem structure and function will have a large part to play in adapting ecosystems to these broad-scale changes. See Box 5.1 for more in-depth exploration of these topics.

2. Example: Mangrove Restoration as an Adaptive Management Strategy

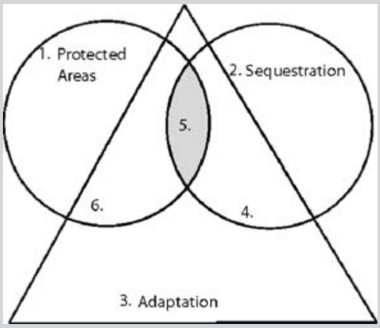
Mangroves provide a concrete example of how restoration can be used as a tool to help enhance resistance and resilience to climate change. Mangroves are clearly vulnerable to rising sea levels, which will change sediment dynamics, cause erosion, and change salinity levels. The rate of sediment buildup, which is the backbone of mangrove survival, is expected to take place at only half the pace of sea-level rise in many places, and mangrove survival will therefore require active restoration. Another aspect of mangroves that makes them an ideal testing ground for restoration is their relative ecological simplicity. Furthermore, the relationship between human and ecological vulnerability to climate change is relatively clear. Low-lying coastal areas, particularly those in tropical Africa, South Asia, and the South Pacific, are predicted to experience among the most severe consequences of global climate change.[50] As these are among the most populous areas across the globe, the livelihoods of many coastal communities that depend on mangrove resources for wood and shrimp farming, will be increasingly tied to their vulnerability to climate change.

Mangrove restoration can do much to limit or delay the negative effects of climate change on associated human and natural communities. Mangroves play an integral role in coastal ecosystems as the interface among terrestrial, freshwater, and marine systems. They are extensively developed on sedimentary shorelines such as deltas, where sediment supply determines their ability to keep up with sea-level rise. They afford protection from dynamic marine processes to both terrestrial and estuarine systems, preventing erosion and chaotic mixing. They also act locally to filter water. Mangrove forests protect sea grass beds and coral reefs from deposition of suspended matter that is transported seaward by rivers and

[49] Hansen et al, 2003.

[50] IPCC, 2001.

Box 5.1. Framework for Understanding Intersection of Resilience-Building and Forest Restoration and Protection



1. **Protection**: For some forests protection alone will not increase resilience to climate change. Many tropical montane cloud forests provide a case in point. Australia's Wet Tropics World Heritage Area is expected to experience a 50% reduction in habitat with warming of 1 degree Celsius, which will leave amphibians and other cool-adapted species no upland migration options as conditions become warmer and drier.

2. **Sequestration via restoration**: Many examples exist where the planting of trees stores carbon but is not coordinated with conservation or resilience-raising advantages. Nonnative trees, such as Eucalyptus, are often planted solely for the carbon benefit, though the planting may cause degradation of the landscape, and thus not provide a buffer against climate change.

3. **Resilience/adaptation**: Restoration is but one of the many types of management options that increase resilience. For example, actions that respond to changing dynamics such as insect infestations and changing fire patterns are aspects of good forestry that will receive special attention with the advent of climate change. Activities that increase the efficiency of resource use will also increase resilience. In Cameroon, mangroves are being aided by increasing the efficiency of wood-burning stoves so that 75 percent less mangrove wood is needed for cooking, thereby increasing the resilience of the system by reducing harvest levels. Such actions decrease degradation of the mangrove and raise the probability that it will be equipped to respond to the effects of climate change.

4. **Sequestration and resilience/adaptation**: Restoration and resilience go hand in hand when the impacts of climate change are taken into account in project planning. Whether passive or active restoration, activities target those areas that will be more suitable to climate change, and encourage use of species that will be hardier under new climatic conditions (successful seed dispersers, for example).

5. **Intersection of protection, sequestration, and resilience/adaptation**: Creating buffer zones through restoration can increase the resilience of protected areas to the impacts of climate change while at the same time sequestering carbon. This scenario is similar to the one above, except that restoration is focussed on increasing the resilience of protected areas by expanding boundaries to increase suitable habitat under changing climatic conditions.

6. **Protection and adaptation**: Protection can lead to increased resilience to the impacts of climate change, where suitable habitat is intact, and the expansion of boundaries is possible to accommodate species' needs with a changing climate. A successful protected area system includes identification and conservation of mature forest stands, functional groups and keystone species, and climate refugia.

provide nursery habitat for many fish species. Deteriorating water quality and coastal degradation are anticipated to be magnified by climate change. Globally, however, many mangrove systems have already been degraded and destroyed. Loss of these buffering systems precludes any protection they might afford. This has been recognised for some time, and many individual projects have attempted to rebuild mangrove systems. However, in the past, the emphasis of mangrove restoration projects has been on planting trees, and this has led to poor survival rates, such as in West Bengal, India, where survival rates in some projects were reported as low as less than 2 percent.[51]

New approaches are therefore required. In addition, simply restoring a mangrove where it has been degraded will not necessarily be enough in the face of climate change. Restoration in an environment where the climate is rapidly changing will require taking into account a few additional elements as opposed to restoration in a stable context. Before starting a restoration programme, two additional steps are required: (1) assess the cause of mangrove loss and evaluate how to remove those causes if possible; and (2) take into account the added complexity relating to how climate change will affect the system: in this case primarily through sea-level rise.

A large-scale mangrove restoration effort in Vietnam has demonstrated that this approach to mangrove management can benefit local resource users and enhance protection from storm surge and sea-level rise.[52] The restoration project in this region has planted more than 18,000 hectares of mangrove along 100 kilometres of coastline. In addition to creating a more stable coastline capable of surviving changing marine conditions, harvestable marine resources are also increasing in number.

Understanding the hydrology (both frequency and duration of tidal flooding) is the single most important factor in designing successful mangrove restoration projects.[53] Incorporating projections of sea-level rise into project design will be necessary so that mangroves are planted or are allowed to colonise naturally or regenerate (this takes 15 to 30 years where stresses leading to degradation are no longer present) in areas that will be more hospitable in the future. If the shoreline is moving, for instance, mangroves may need to be restored some distance from their original location.

3. Outline of Tools

This section offers a framework for integrating knowledge about climate change to forest managers who are considering restoration. It is based on an understanding of how adaptation (in this case to climate change) needs to be integrated with both restoration and protection, as outlined in Box 5.1 above.

3.1 Vulnerability Analysis

To understand how climate change will affect an existing forest system, an analysis of the vulnerability of the defined area can be undertaken. As a first stop, climate change impacts on the major forest types are presented in WWF's *Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems,*[54] with examples from many different regions collected from the literature. For more specific information on a particular site, a literature search may identify whether a vulnerability analysis has been made of the project area in question.

If limited information on climate change impacts exists for the selected site, a vulnerability analysis can be commissioned to feed into project design activities. An expert conversant in climate change science as well as biological science for the region can piece together a picture of regional vulnerability that will help to guide project activities so that they can take account of likely alterations in environmental conditions as the climate changes. At a large

[51] Sanyal, 1998.

[52] Tri et al, 1998.

[53] Lewis and Streever, 2000.

[54] Hansen et al, 2003 (available on www.panda.org).

scale, major shifts in biome types can be projected by combining biogeography models such as the Holdridge Life Zone Classification Model with general circulation models (GCMs) that project changes under a doubled CO_2 scenario. Biogeochemistry models simulate the gain, loss, and internal cycling of carbon, nutrients, and water-impact of changes in temperature, precipitation, soil moisture, and other climatic factors that give clues to ecosystem productivity. Dynamic global vegetation models integrate biogeochemical processes with dynamic changes in vegetation composition and distribution. Studies on particular species comparing present trends with paleoecological data also provide indications for how species will adapt to climate change.[55]

A vulnerability analysis can help to assess what systems or aspects of the systems have greater resilience and resistance to climate change impacts. This type of information can help to identify sites that have greater long-term potential as ecosystem "refugia" from climate change impacts. Some refugia exist due to their unique situational characteristics, but their resilience could be enhanced by management and restoration.

3.2 Restoration as a Resilience/Adaptation Strategy

After completing a vulnerability analysis to determine how a forest system may be impacted by changing climatic conditions, the next step is to look at the range of adaptation options available in order to promote resilience. An effective vulnerability analysis will determine which components of the system—species or functions, for example—will be most vulnerable to change, together with consideration of which parts of the system are crucial for ecosystem health. An array of options pertinent to adapting forests to climate change are available, both to apply to forest communities at high risk from climate change impacts as well as for those whose protection should be prioritised given existing resilience. Long-term resilience of species will be enabled where natural adaptation processes such as migration, selection, and change in structure are allowed to take place due to sufficient connectivity and habitat size within the landscape.

Restoration can provide a series of critical interventions to reduce climate change impacts.[56] Basic tenets of restoration for adaptation include working on a larger scale to increase the amount of available options for ecosystems, inclusion of corridors for connectivity between sites, inclusion of buffers, and provision of heterogeneity within the restoration approach. Key approaches are as follows:

Reduce fragmentation and provide connectivity: Noss[57] provides an overview of the negative effects of ecosystem fragmentation, which are abundantly documented worldwide. "Edge effects" threaten the microclimate and stability of a forest as the ratio of edge to interior habitat increases. Eventually, the ability of a forest to withstand debilitating impacts is broken. Fragmentation of forest ecosystems also contributes to a loss of biodiversity as exotic, weedy species with high dispersal capacities are favoured and many native species are inhibited by isolation. Restoration strategies should therefore often focus first on those areas where intervention can connect existing forest fragments into a more coherent whole.

Provide buffer zones and flexibility of land uses: The fixed boundaries of protected areas are not well suited to a dynamic environment unless individual areas are extremely large. With changing climate, buffer zones might provide suitable conditions for species if conditions inside reserves become unsuitable.[58] Buffer zones increase the patch size of the interior of the protected area and overlapping buffers provide migratory possibilities for some species.[59] Buffer zones should ideally be large, and managers of protected areas and surrounding lands must demonstrate considerable flexibility by adjusting

[55] Hansen et al, 2001.

[56] Biringer, 2003; Noss, 2001.

[57] Noss, 2000.

[58] Noss, 2000.

[59] Sekula, 2000.

land management activities across the landscape in response to changing habitat suitability. A specific case for a buffer zone surrounding tropical montane cloud forests can be made based on research that shows that the upwind effects to deforestation of lowland forests causes the cloud base to rise.[60] Restoring forest around protected areas, for example to supply timber through continuous cover forestry, or for nontimber forest products, watershed protection, or as recreational areas, could help maintain the quality of the protected area in the face of climate change.

Maintain genetic diversity and promote ecosystem health via restoration: Adaptation to climate change via selection of resilient species depends on genetic variation. Efforts to maintain genetic diversity should be applied, particularly in degraded landscapes or within populations of commercially important trees (where genetic diversity is often low due to selective harvesting). In such places where genetic diversity has been reduced, restoration, especially using seed sources from lower elevations or latitudes, can play a vital role in maintaining ecosystem resilience.[61] Hogg and Schwarz[62] suggest that assisted regeneration could be used in southern boreal forests in Canada where drier conditions may decrease natural regeneration of conifer species. Similarly, genotypes of beach pine forests in British Columbia may need assistance in redistributing across the landscape in order to maintain long-term productivity.[63] In addition, species that are known to be more resilient to impacts in a given landscape can be specifically selected for replanting. For example, trees with thick bark can be planted in areas prone to fire to increase tree survival during increased frequency and severity of fires.[64]

60 Lawton et al, 2001.
61 Noss, 2000.
62 Hogg and Schwarz, 1997.
63 Rehfeldt et al, 1999.
64 Dale et al, 2001.

4. Future Needs

Documentation of the role restoration plays in building resilience to climate change is in its infancy. Although field projects are beginning to test restoration as a resilience-building tool, we are far from definitive guidance. Unfortunately, this is the nature of the practice of conservation; decisions based on best knowledge need to be made now while we continue to gather more information. Otherwise, opportunities will be lost.

To meet these needs we propose additional field projects to test, confirm, and develop restoration's role in building resilience to climate change. This needs to be conducted across different forest types with as much replication as possible. A strong monitoring component is necessary for any such project, especially given the complex relationships between species' structure, composition, and functioning on which climate change is unfolding. The results of monitoring will also enable lessons to be drawn from resilience-building efforts, and to compare these with similar "control" landscapes or other resilience-building projects in different regions with similar habitat type.

Ideally, resilience-building management strategies will serve as another layer in a comprehensive forest management plan that has as its objective the overall health of the forest ecosystem. For example, many WWF ecoregional visions are adding vulnerability to climate change as another component that will drive conservation decisions. Such anticipatory resilience-building plans take climate change into account during the planning process, and will better ensure synergies with other management priorities. A number of scientific, governmental institutions and non-governmental organisations (NGO) are acquiring expertise in the area of climate change impacts and adaptation/resilience. It will be fruitful to seek partnerships with these institutions at the beginning of any restoration project to analyse climate impacts and proposed restoration activities.

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Section III
Forest Restoration in Modern Broad-Scale Conservation

6 Restoration as a Strategy to Contribute to Ecoregion Visions

John Morrison, Jeff Sayer, and Colby Loucks

Key Points to Retain

Ecoregion conservation is a large-scale, long-term, and flexible concept whose purpose is to meet the four goals of biodiversity conservation: representation, maintenance of evolutionary processes, maintenance of viable populations, and resilience.

In degraded landscapes and ecoregions restoration goals and strategies will be critical to the success of an ecoregion vision.

But as restoration can be energy intensive, its role must be defined in the context of quantifiable goals related to the four larger goals of biodiversity conservation.

1. Background and Explanation of the Issue

Most people are aware of the global reduction in forest cover as a result of ever-increasing human domination of the planet. The impacts are felt on biodiversity and on people as shown in the previous chapters of this book. A natural reaction to this forest loss is to engage in forest restoration activities.

Across the planet, conservationists are working to increase overall forest coverage using a variety of strategies. In some cases this includes attempting to intensify agriculture so that it requires less land, focussing on value over volume in wood products, and concentrating production in (native) plantation forests. Another strategy is to de-intensify agricultural uses and promote a mosaic of natural and anthropogenic elements, allowing native species and communities to fill in around our use of the landscape, and provide necessary ecosystem services to operate more freely.

In any case, the competition for land among a range of interests and stakeholders necessitates that all forest conservation activities, including forest restoration, be strategic and for a specific purpose(s), be it conservation or otherwise. This strategic focus should ideally be identified through a participatory process that leads to a long-term "vision" for the desired future state of the area. Increasing the quality and quantity of forest cover is an important general goal for conservation, both for ecosystem services (watershed protection, climate regulation, etc.) and for the needs of those species that depend on forests. However, due to the intense competition for land between the forces of development and conservation, efficiency in how and where forest restoration occurs is critical. In other words, while increased tree cover will nearly always be beneficial from a conservation perspective, if possible, restoration efforts should be focussed in such a way that multiple conservation and social goals are reached (also see sections "Restoring Ecological Functions" and "Restoring Socioeconomic Values"). Meeting both conservation and social goals simultaneously maximises the chances that the activities will be sustainable and that they will have local support. An example of this integration is provided by the activities in the Upper Paraná Atlantic Forest. Within this ecoregion forest patch connectivity is being improved through the incorporation of native plants that can also be sustainably used by local people (see case study "Finding Economically Sustainable Means of Preserving and Restoring the Atlantic Forest in Argentina").

What are the primary conservation goals that we should be trying to achieve?

1.1. The Four Goals of Biodiversity Conservation and Ecoregion Conservation[65]

The goals of biodiversity conservation and ecoregion conservation are as follows:

1. Representation of all distinct natural communities within conservation landscapes and protected areas' networks
2. Maintenance of ecological and evolutionary processes that create and sustain biodiversity
3. Maintenance of viable populations of species
4. Conservation of blocks of natural habitat large enough to be resilient to large-scale disturbances and long-term changes

Because these conservation goals often operate over large spatial and temporal scales, the design of conservation programmes "requires a perspective that spans nations and centuries."[66] Large-scale conservation initiatives have become standard in a number of conservation organisations over the last decade. This evolution is seen as a reaction to the often disjointed, isolated, and nonstrategic activities that once characterised site-level conservation. While site-level conservation will always be an important and, many would argue, the most important scale of conservation intervention, site-level activities can be planned in the context of larger scale (landscape and ecoregion) visions. The thinking behind using large biogeographic units as the framework in which to achieve conservation goals is that natural communities, species, and even human threats to biodiversity move and operate at large scales, often irrespective of political boundaries. Actions conceived at the same scale as the ecological entities and processes that the actions are trying to protect should be more robust and efficient than uncoordinated efforts at a site scale. At WWF, the global conservation organisation, this evolution has taken the form of Ecoregional Conservation (ERC). Ecoregion conservation is really a philosophy that espouses using large, biogeographically defined units as an arena within which to achieve the four goals of conservation outlined above. The actual process of ecoregion conservation planning has followed a number of paths, generally relying on experts, computer algorithms, or even a mixture of the two to identify conservation priorities.

A range of spatial scales has been addressed to date, under the heading of "ecoregion conservation." A system of ecoregional boundaries of the world has been stitched together by WWF.[67] This system is also used by the Nature Conservancy. Conservation effort is not applied equally across this system. WWF has defined 825 terrestrial ecoregions (Fig. 6.1), of which a large proportion is forest ecoregions of various subtypes (tropical dry, tropical moist, temperate moist, etc.). A further analysis by WWF identified 237 groupings of these terrestrial ecoregions as being of particular importance to conservation and named these the Global 200 Ecoregions—it is usually these Global 200 ecoregions that are the focus of WWF Ecoregion Action Programmes.[68] In the process of analysing ecoregions, "priority areas" or "priority landscapes" are often identified that become the subject of further conservation planning and initiatives. Thus the general hierarchical spatial scale, from largest to smallest, is Global 200 ecoregion, terrestrial ecoregion, and priority landscape—but this is not a steadfast rule,

[65] Noss, 1992.
[66] Scott et al, 1999.
[67] Olson et al, 2001.
[68] Olson and Dinerstein, 1998.

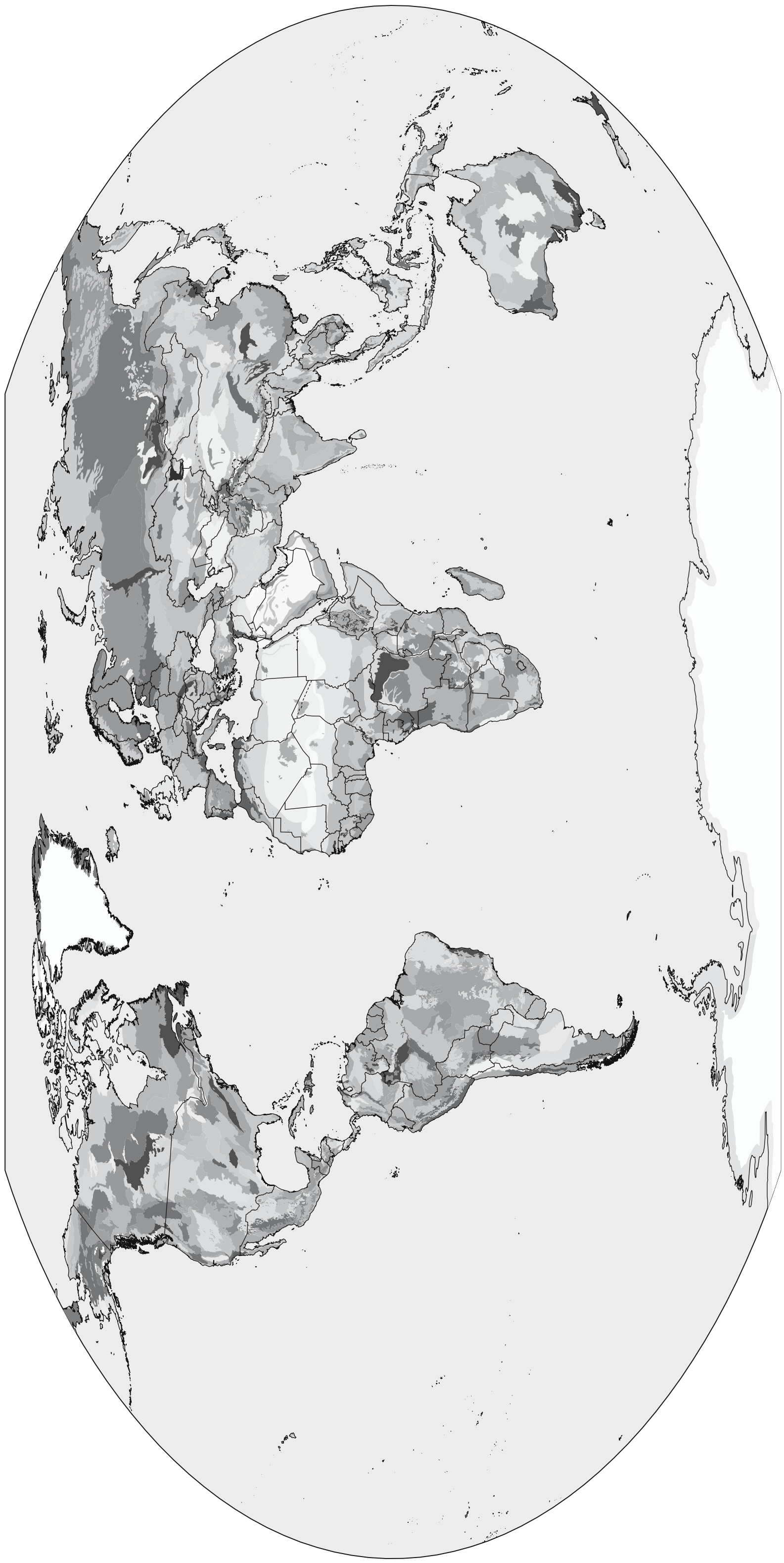

Figure 6.1. Terrestrial ecoregions of the world. (*Source:* WWF.)

and there are very small ecoregions (tens of km^2) and very large priority landscapes (thousands of km^2). Most of the principles discussed below hold for a range of scales, from the landscape to the ecoregion.

1.2. Protect, Manage, and Restore

More than likely, any comprehensive conservation strategy in an ecoregion will involve a combination of protection, management, and restoration, plus the abatement/amelioration of threats. The relative proportion of each strategy that is appropriate is a function of both the overall conservation status of the ecoregion, and the location in the ecoregion—and this will change over time. For example, restoration is not necessarily an appropriate strategy in all ecoregions or landscapes. One can imagine that restoration may not currently be the highest priority in those ecoregions that are composed mostly of wilderness or large forest blocks, such as in the Amazon. A primary output of many ecoregional visions is a map of priority areas, where conservation activities are more focussed than in the surrounding matrix of the ecoregion. Yet even in the matrix, some proportion of protection, management, and restoration activities will be appropriate, and in the case of the wilderness ecoregions mentioned above, over the long-term, restoration may rise in priority in those ecoregions as more comprehensive protection and better management are instituted.

From a conservation standpoint, the decisions about how much protection, management, and restoration will be a natural consequence of attempting to achieve the above four conservation goals in a strategic fashion in an ecoregion or a landscape within that ecoregion. Is there enough of a given target habitat present in the ecoregion or landscape to meet representation objectives that we can simply protect a (greater) proportion of it? Or will some areas containing that habitat need active or passive restoration in order to meet the prescribed target for that habitat? Can existing multiuse buffer zones of forest simply be managed in their current state to provide landscape connectivity, or will some areas need to be rehabilitated to restore connectivity?

Forest "restoration" activities range from active planting, to management (e.g., invasive species' removal), to more passive restoration (creating the conditions that will allow natural processes to regenerate high-quality forest). Because active restoration is so resource intensive, it should generally be the last option selected to meet a conservation objective. The key point is that from a conservation perspective restoration activities should not be undertaken for the sake of restoration; rather, the activity should be a strategic response to a specific need identified during the formation of conservation goals. The Forests of the Lower Mekong ecoregion has endeavoured to find the right balance of protection, management, and restoration—all stemming from the conservation goals highlighted during the ecoregional vision process.

2. Examples: Restoration and the Four Conservation Goals

Conceptually, it is a relatively simple matter to decide whether restoration is necessary or not. By selecting conservation targets that are applicable to the aforementioned four goals of conservation, it should quickly become clear whether or not the relevant ecoregion or priority landscape still contains the necessary components to satisfy all four goals. If there are elements missing or the ecoregion/landscape is too fragmented, some restoration is probably necessary. At the basic level of the four conservation goals, the following discussion illustrates how the need for restoration can be identified.

2.1. Representation

Conservationists need to represent all natural communities in some sort of a conservation network, which is generally a mix of different levels of protection. It is important that the mix of natural communities is one that has existed before a major disturbance rather than the existing mix. But all of these original communities may no longer be present in the quantity and quality necessary, and that is where the potential application of restoration comes in. This is especially true during periods of climate change when species will need to move in response to changing conditions.

One of the first steps in any conservation planning initiative is to obtain or develop a map of historic (sometimes called "potential") natural community types across the entire ecoregion/priority landscape. A number of coverages may suffice for this purpose, including historic vegetation maps, potential vegetation maps, or maps of plant communities or ecosystems. In the case where land conversion has made this task impossible, maps of environmental domains, which are unique combinations of substrate (soils or geology), elevation, and climate classifications, may be developed. If these environmental domains are carefully developed, they should represent unique environmental classes that correlate with the species living in them.

It is common practice for a target level of representation to be chosen for each natural community type (or environmental domain). This is not always easy, but endeavouring to determine what these levels should be (preferably on an individual habitat-by-habitat basis rather than a blanket prescription) is one of the highest callings of a conservation biologist. It is altogether appropriate to begin with coarse estimates that can be improved over time. Custom representation targets are preferable to blanket prescriptions. Once an appropriate level of representation of each historic natural community is decided (20 percent, 30 percent, 50 percent, etc.), it may be discovered that less intact habitat of a particular type(s) remains than the target representation amount. This is a sign that some restoration is in order. Madagascar and the dry forests of New Caledonia are prime examples—forest conversion has proceeded so far in these ecoregions that forest restoration is required to meet the most basic habitat representation goals.

It should also be noted that each natural community is itself made up of seral stages, and the appropriate mix of seral stages, or more likely the allowable ranges of seral stages, corresponding to a natural range of variation, must be specified. The ability of a natural community type to support a natural range of seral stages must be protected, or if necessary enhanced, and this may also require some forest restoration activities. An example is the relative lack of primary, or old-growth forest, in many temperate forest ecoregions compared to historic levels. Efforts to increase the proportion of late seral stages are an appropriate application of forest restoration in this case.

Many ecoregional programmes, especially those in developed or densely populated countries, have found that the amount of lowland and riparian communities are in short supply—they have already been converted for human uses. Clearly in such situations, restoration will necessarily be an important component of the overall conservation strategy if representation targets are to be met.

2.2. Viable Populations

The idea behind this goal is that all species should have conserved viable populations, but in practice it is never possible to plan for all species (if for no other reason than that all species are never really identified). During any large-scale conservation initiative, therefore, focal species are selected for special attention. Focal species are chosen because they are "keystone," highly threatened endemics, habitat specialists, or because they are very "area-sensitive" and act as umbrellas for a number of species with smaller area requirements. The number of focal species chosen will vary from ecoregion to ecoregion, and certainly from priority landscape to priority landscape, but is generally a manageable number of five to 20 species from the above categories.

After determining what the list of focal species is, the next step is to determine the number of breeding individuals that represent a viable population, or potentially a viable subpopulation in the case of a priority landscape. This is not a trivial determination, and there is an extensive literature discussing rules of thumb for the number of breeding individuals that constitutes a viable population—with little consensus. In some cases a species-specific and resource-intensive population viability analysis (PVA) will be necessary. If a viable population estimate is difficult to come by or there are severe limits to the number of individuals that are possible, the bottom line is that a target level should be chosen that represents the largest conceivable achievable population level.

For restoration purposes, the specific needs of each focal species must be analysed individually. A number of related metrics, including minimum patch size, connecting patches to enlarge the effective habitat area or feature (breeding, feeding, or nesting areas/cavities), corridor width, specific habitat requirements (plant species), access to water, etc. must be considered. During the course of the analysis to determine the habitat and total area requirements for each species, it should quickly become clear if there is not enough habitat necessary for a viable population of a particular species—and restoration will be necessary. This is frequently the case in those ecoregions that have been highly degraded.

The reconnection of now disjunct habitat patches is a common application of forest restoration activities. This is the focus of the current work in the Terai Arc in the Eastern Himalayas: reconnecting 10 protected areas by encouraging the growth of community-managed forests (Fig. 6.2). Tigers are loath to cross more than 5 km^2 of nonhabitat, but the existing protected areas are not large enough to maintain viable populations of tigers. Some mixing of the respective populations is desirable. Therefore, community forests are being encouraged where gaps in forest cover are noted between the existing protected areas. This will allow tigers, greater-one horned rhinoceroses, and Asian elephants to disperse between patches of prime habitat. Restoration is an important activity in other fragmented ecoregions that still contain large carnivores, including for jaguars in South America's Atlantic Forest and for wolves and grizzly bears

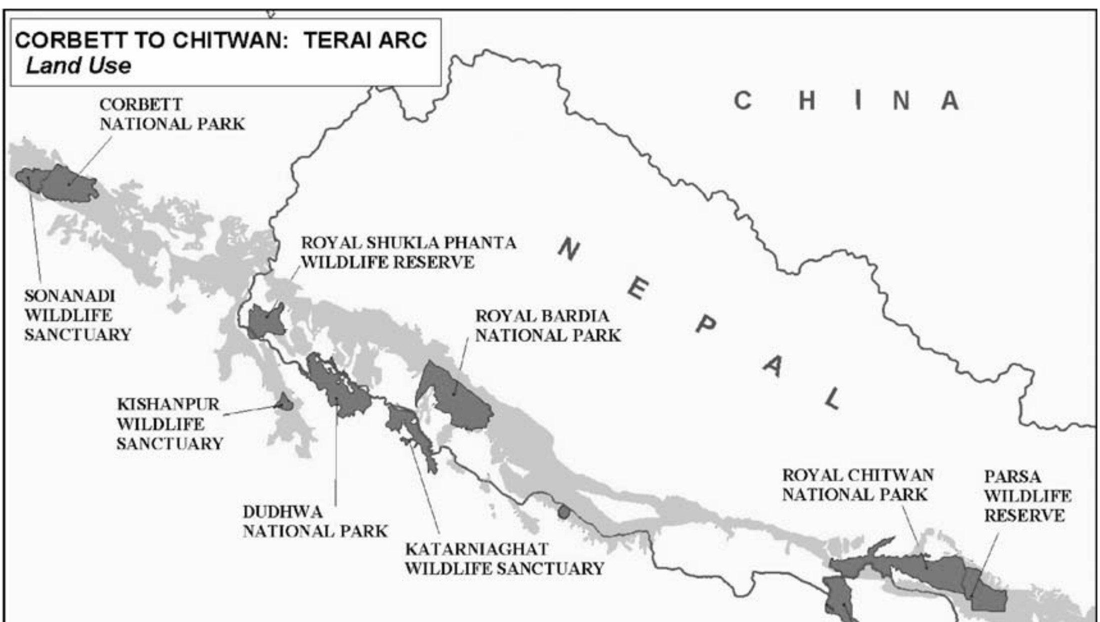

FIGURE 6.2. Reconnecting protected areas (dark) with forest restoration (light). (*Source*: WWF.)

in the ecoregions of the Northern Rockies of North America.

2.3. Ecological and Evolutionary Processes

The many evolutionary and ecological processes that create and sustain biodiversity are complex, and often poorly understood. Gene flow, migration, pollination, seed dispersal, predator–prey dynamics, and nutrient cycling are some of the many that should be considered when a conservation plan is developed. All of these processes can potentially benefit from restoration activities, because many species (and the processes that they are involved in) will respond positively to restored forest quality, but some of them will benefit more obviously than others. Gene flow and migration can directly benefit from restored forest corridors, as in the above examples. Likewise, if key processes such as pollination or seed dispersal are threatened by insufficient forest area to support the species that are performing these functions, restoration activities would be appropriate.

In some regions, reduced forest cover threatens to throw the area into a not-easily-reversible regional climatic shift. Restoration of forest cover (that simultaneously meets finer scale representation targets and is configured to maximise forest block size for area-sensitive species) would be a high priority activity.

The Terai Arc is also a good example for this set of conservation goals. By reconnecting disjunct forest patches and thus tiger subpopulations, the ecological processes of subadult dispersal, gene flow, and restoration of predator–prey dynamics can be restored. Because systems with large predators are often dominated top-down forces (in this case elephants and tigers), the reintroduction of tigers and elephants across the entire landscape will help put a number of natural ecological processes back into a more natural dynamic balance. However, the needs of finer-scale habitat specialists (particularly for breeding or feeding) within the larger area should not be overlooked.

2.4. Environmental Change

Planning for inevitable environmental change (even without the additional spectre of anthropogenic climate change) is a key precept in conservation. Ecological systems are by their very nature dynamic, and it is important to incorporate large habitat areas and sufficient connectivity between habitat areas in order to build resiliency into the protected area network. Increased connectivity is the main option available to conservation planners trying to anticipate the effects of anthropogenic climate change. Species' ranges are already beginning to shift in latitude and altitude; this is true not only for animals but for plant species as well. Again, reconnecting now disjunct habitat patches through restored forest corridors is an appropriate application for forest restoration activities to help migration to keep pace with changing conditions. In addition, managing the landscape in such a way that it provides more flexibility for species and gene flow in times of stress is an important element of restoration.

This connectivity strategy will be important for every ecoregion across the planet to consider. Ecoregions likely to be faced with this threat in the near term are tropical montane ecoregions that contain significant topographic relief. Climatological changes are concentrated in narrow bands, and maintaining altitudinal connectivity will be critical for allowing habitats to shift in response to changing temperature and moisture regimes.

Restoration activities are important for all ecoregions where human activities have fragmented the ecoregion, and this includes most ecoregions. Rising temperatures and changing precipitation patterns will cause natural communities to shift latitudinally and altitudinally. Without restoration to reconnect fragmented habitat patches with corridors, natural communities will have great difficulty shifting across human-dominated landscapes. A more specific example of the need for restoration will be in tropical coastal ecoregions with mangroves. As sea level continues to rise, mangrove belts will tend to shift inland (Fig. 6.3). However, if the landward edge of the mangrove belt has been degraded, which it commonly is, space and

FIGURE 6.3. Mangrove belts along coastal areas are expected to shift inland with rising sea levels. (Photo © John Morrison.)

restoration activities will be necessary to allow the continued persistence of the mangroves, and with them the important ecological (and social) functions they perform.[69]

2.5. Deciding Where to Do Restoration When There Are Choices

In the preceding discussion, the need for restoration fell into two broad categories: increasing the area of a particular forest type for representation or for particular species/processes, and restoring particular landscape features, especially corridors, which allow specific ecological processes to operate. Sometimes there are choices of where restoration is most appropriate. All other things being equal, it is generally easier to restore the less degraded example of a forest type, since less effort or time will be required. All other things are rarely equal, however. How does one decide which semi-irreplaceable example of a forest type to restore if there are several choices? Obviously, many factors must often be weighed.

The first step is to be clear about the end objective(s). For example, is primary forest the only possible objective, or would secondary forest do just as well (or even better) for the focal species being considered? Factors to consider when determining which area to restore are the following:

- The current condition of the forest area in question—how much effort/time is required to restore?
- Proximity to other viable habitats, to allow species to disperse or facilitate later reconnection
- Proximity to the existing or anticipated urban frontier

This last bullet point highlights an entire class of information that can help to assure that restoration activities (and in fact any conservation activities) have the greatest chance of success. The mapping of human population density, distance from access corridors, government capacity, ethnic stability and homogeneity, and similar factors can help a project see where the threats and opportunities lie across the ecoregion or landscape. Additionally, the incorporation of socioeconomic information and consultation will help to assure that restoration activities undertaken for ecological reasons will also benefit local people either through ecological services or even through employment in restoration activities.

3. Outline of Tools

As already noted, ecoregion conservation in the WWF network is more of a philosophy than a particular methodology, and a number of methodologies have been used to achieve the four goals of conservation. This is altogether appropriate, since there is a great variety of

[69] Noss, 2001.

data availability, social structures, infrastructure, and professional capacity in the ecoregions across the planet. There is no tool especially tailored to help set restoration priorities. These priorities should emerge from a generic comprehensive planning process.

A full discussion of the tools available for ecoregional conservation planning is beyond the scope of this paper. Some of the primary tools include:

- WWF's approaches to ecoregion conservation,[70] including specific advice about actions in priority conservation landscapes[71] and case studies[72] and a detailed guide to implementation within ecoregions[73]
- The Nature Conservancy's approach to ecoregion conservation[74]
- Systematic conservation planning approaches as developed in New South Wales, Australia[75]

The use of a geographic information system (GIS) is practically mandatory when considering spatial planning for conservation. The GIS allows spatial maps to display conservation options, and more powerfully, allows the user to combine biological and socioeconomic information to analyse ways of meeting conservation goals at the least socioeconomic "cost." Additional tools that work alongside and with a GIS are decision support software tools, which allow numerous competing variables to be combined. Depending on the particular tool used, a single best conservation configuration may be generated or a range of choices can be portrayed. In some of these tools, once a decision is made regarding a particular portion of the landscape, the entire study area can be recalculated to portray the next best options.

4. Future Needs

Further development is needed for tools to prioritise restoration needs. Current decision support tools are able to identify remaining habitat for inclusion in protected area networks, and these tools can be used to work with maps of previously existing potential vegetation. However, further refinement of these tools and associated techniques to identify areas that could be restored to meet representation goals is needed.

[70] Dinerstein et al, 2000.
[71] Loucks et al, 2004.
[72] Palminteri, 2003.
[73] WWF, 2003.
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7 Why Do We Need to Consider Restoration in a Landscape Context?

Nigel Dudley, John Morrison, James Aronson, and Stephanie Mansourian

Key Points to Retain

Restoration is already needed in many important forest ecosystems because loss and degradation have proceeded to a point where the ecosystem is no longer sustainable in the long term.

Approaching restoration on a landscape scale means addressing conservation issues while considering social concerns, at a scale where optimisation and trade-offs are easier to agree on than at the site level.

Most current restoration activities tend too often to focus on one or two benefits and miss the wider picture.

Tools are starting to be developed that help to negotiate realistic mixes of management actions, including a suite of restoration activities, and biodiversity protection, at the full landscape scale.

1. Background and Explanation of the Issue

The landscape is the spatial and ecological scale at which the range of different ecological, social, and economic needs and desires of stakeholders can best be discussed, compared, and integrated.

1.1. Why Restore?

Conservation strategies that rely solely on protected areas and sustainable management have proved insufficient either to secure biodiversity or to stabilise the environment. The United Nations Environment Programme now classifies a large proportion of the world's land surface as "degraded," and reversing this damage is one of the largest and most complex challenges of the 21st century. Habitat loss is already so severe that conservation programmes need to include restoration if they are to deliver long-term success. Analysis of the WWF Global 200 ecoregions—identified as those of the highest conservation importance—demonstrates the problems. Over 80 percent of the G200 forest ecoregions need restoration in at least parts of their area; deforestation is a key threat to water quality in 59 percent of G200 freshwater ecoregions, and three quarters of G200 mangrove ecoregions are under threat.[76] Even where forest is stable or increasing, parallel losses of forest quality create the need for restoration. In Western Europe, for instance, research by the United Nations Economic Commission for Europe found that most countries had less than 1 percent of their forests surviving in an unmanaged state.[77]

Forest loss is not only of concern to conservationists. The United Nations estimates that 60 million people are directly dependent on forest

[76] Dudley and Mansourian, 2000.
[77] Dudley and Stolton, 2004.

resources including many of the poorest people. A far larger number are indirectly dependent, for example, on environmental services from forests such as soil and watershed protection. Forests also provide a wealth of recreational, spiritual, and aesthetic services.

1.2. Why Landscapes?

Many restoration efforts have ended in failure (see "Forest Landscape Restoration in Context"). Some of the reasons for this relate to their limited scope, their lack of engagement with local people and other stakeholders' interests and needs, their short-term nature, and their failure to address underlying causes of forest loss and degradation. In the last decade or so it has become increasingly clear to conservationists that developmental and socioeconomic concerns cannot be overlooked if conservation is to be successful. Conservation activities, therefore, inevitably take place alongside other aspects of sustainable development, and a landscape approach can help to embrace both aspects of conservation and development. Because the restoration of forests in landscapes aims to repair and recover forest products and services that are valuable to people, it has a key role to play in development programmes. Balancing competing ecological and social needs is always difficult, but is most likely to succeed if we work on a large enough area to encompass two or more interactive ecosystems, as well as different landscape units with different land uses by local people. This facilitates negotiation and trade-offs among different demands.

Thus, rather than relying on a series of individual projects attempting to restore individual forest values, at the landscape scale it becomes possible to attempt the integration of these projects. Where successful, the net result should be much more than the sum of individual site-based restoration actions. Achieving a balance between the various goods and services required from restored forest ecosystems requires conceptualisation, planning, and implementation on a broader scale. It also assumes some negotiations and trade-offs among the various stakeholders involved to identify those restoration actions that have enough of a groundswell of support to be likely to succeed. A landscape or ecoregion approach also allows forest restoration to be fully integrated with protection and sustainable management of forest.

From the perspectives of biodiversity, long-term viability and ultimately social and economic values, approaches to restoration need to focus on forest functions and ecological processes. A key concern in many restoration projects is increasing the size of core areas of forest habitat. However, where space is limited by competing land uses, many functions of a large forest can be simulated by increasing connectivity between patches of forest by biological corridors and ecological stepping stones (patches of habitat that can provide "way stations" for migrating or mobile species). Increasing the values of existing forests, for example by changing management or decreasing interference, can also play a vital role in restoration. The landscape scale also allows us to consider the links between different habitat types. The interface between habitats may be abrupt (particularly in managed landscapes) or gradual, and they will have a varying ability to allow dispersal and interchange of species (see "Restoring Tropical Montane Forests"). Increasing the permeability of habitat boundaries to genetic interchange may be as important as specific habitat creation such as biological corridors.

1.3. Protect, Manage, Restore in a Landscape

The result of integrating efforts to restore multiple functions at a landscape scale often resembles a mosaic, where protected areas, other protective forests, and various forms of use and management are combined, depending on existing and evolving needs, legislative constraints, and land ownership patterns. Restoration becomes a management option that can be used within any part of the landscape to contribute to the overall long-term aims for the landscape. Agreeing on the mosaic and balancing different social, economic, and environmental needs on a landscape scale requires careful planning and negotiation.

A landscape approach recognises that overall landscape values and services are more important than individual sites, and that in a world of competing interests, conservation aims need to be integrated with those of, for example, poverty alleviation, human health, and other legitimate forms of social and economic development and welfare. Conservation cannot, or should not, take place divorced from issues relating to human well-being, and people working for conservation are usually also concerned about social justice and sustainable development. The appropriate approach, therefore, is to identify where and how these different but overlapping interests can best be integrated into a multifunctional landscape. Such integration will necessarily include negotiation and trade-offs.

1.4. The Process of Restoring Forest Functions in a Landscape

Deciding what forms of restoration to apply requires a suite of different activities, including careful analysis of what is needed, assessment of what is possible, and agreement amongst relevant stakeholders about the aims of restoration and the appropriate actions to undertake. It is axiomatic of forest landscape restoration that in most cases we are not looking at a single project or a single forest use, but rather at a range of different restoration efforts that will, as far as is feasible, be coordinated and complementary. The extent to which this is attainable in practice depends on the willingness of different groups of stakeholders to cooperate, the negotiation skills of those involved, and hard-to-define issues such as ownership patterns and other demands on the landscape. In areas where much of the land is in private ownership, many "common goods" including conservation can only be addressed through voluntary agreements, land purchase, or overarching policy decisions, and all of these options are slow and laborious to achieve in most situations.

2. Examples

Some examples show how different countries or regions have approached issues of restoration and how different priorities have shaped and in some cases distorted options for restoring a balanced forest mosaic.

2.1. Switzerland: Restoration for Environmental Services but with Additional Economic and Biodiversity Values

Following severe erosion and flooding problems in the past resulting from historical deforestation, during the 19th and 20th centuries Switzerland devised a system of continuous cover forestry to protect slopes and provide resources and fuel. The government has one of the few forest policies that explicitly rank social and protective functions above commercial functions. The country has 1,204,047 hectares of forest and woodland, covering 29 percent of the country.[78] Trees within managed forests are generally native and around 60 percent are conifers, with almost half the growing stock being Norway spruce. Although forest management is less intensive than in many European countries on a stand level, it affects virtually the entire forest area, and there are very few old-growth forests. Around 0.5 percent of forests are in natural forest reserves. Landscape-scale planning has played a critical role in identifying where best to restore forests, with an emphasis being placed on avalanche control, stabilisation of slopes, provision of local firewood, and biodiversity conservation.[79]

2.2. Guinea: Traditional Management Including Forest Restoration

Careful research with villages on the forest-savannah interface in Guinea, in West Africa, found that rather than contributing to deforestation as was once thought, local communities were actually planting and tending forest patches. Once villages were abandoned (a periodic response to declining soil fertility so that communities moved every few decades), such forests tended to decline and disappear as a

[78] Holenstein, 1995.
[79] McShane and McShane-Caluzi, 1997.

result of increased grazing pressure from savannah herbivores. New areas were chosen on the basis of past use and where fertility was likely to have recovered, thus focussing on different parts of the landscape at different times to ensure long-term continuity. Villagers established forest patches on the edge of the grassland to provide needed nontimber forest products and protected these from fire and grazing.[80]

2.3. United Kingdom: Plantations Replacing Natural Forests and Dominating the Landscape

Following the First World War, concern about lack of timber led to the establishment of the Forestry Commission, which was provided with considerable funds and political power to undertake compulsory purchase, to establish fast-growing plantations of trees. The emphasis was on conifers, particularly Sitka spruce (*Picea sitchensis*) from Alaska. Many of these plantations were established on upland grazing areas (which were originally forested but had lost their tree cover, in some cases centuries before). Some plantations were also established on the site of native woodland, which was occasionally cleared with herbicides, and in northeast Scotland on moor that had never contained trees. Whilst the planting was successful in creating a strategic reserve, it led to resentment about loss of access, native woodlands, and other natural habitats, and a limited range of forest functions. Dense forest created access problems and the abrupt boundaries between this and other habitat limited usefulness for biodiversity. Planning was usually at site rather than landscape scale. From the 1980s onward, the commission started revising its aims, increasing native planting and playing a more general stewardship role in land management; experiments are also taking place in returning woodland areas to local community control.[81]

[80] Fairhead and Leach, 1996.
[81] Garforth and Dudley, 2003.

2.4. Costa Rica: Shade-Grown Coffee as a Linking Habitat in Fragmented Landscape with a High Population Density

Although Costa Rica still contains large areas of native forests, some forest ecosystems have declined to a fraction of their former size and are no longer ecologically viable, particularly in Talamanca and Guanacaste. In the former area, The Nature Conservancy (TNC) has been working with local communities to link remaining forest fragments to allow access for birds. Because pressure on land was too intense to allow space for native woodland as such, shade grown cacao and coffee production was encouraged and supported, planned at a landscape scale to link remaining forest fragments. While far from a natural woodland, the trees shading coffee provide habitats to allow passage for rare birds, thus allowing them to form viable populations.[82]

The above cases illustrate only a fraction of the possible examples. They show that in most places where restoration is encouraged, its purpose is generally fairly narrow (also see "Goals and Targets of Forest Landscape Restoration"): erosion control, strategic reserves, etc. If other benefits accrue, it has sometimes been fortuitous. One of the key aspects of forest landscape restoration is to reduce the elements of chance and increase the sophistication of restoration planning.

3. Outline of Tools

3.1. Ecoregional Planning Tools

A wide range of possible tools exist to plan regional scale forest cover and management (see also previous chapter). Among the most popular are the following:

- Ecoregional workshops: used to help establish a vision for an ecoregion, prioritise actions and conservation landscapes, and develop strategies

[82] Parrish et al, 1999.

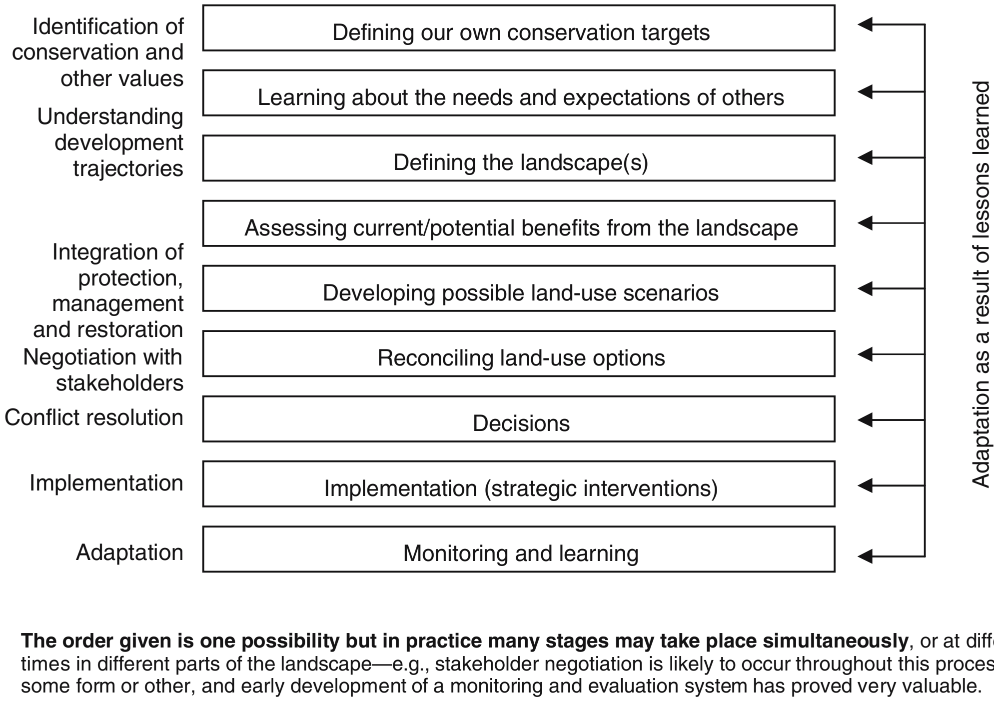

FIGURE 7.1. Protect–manage–restore approach.

- Computer-aided design packages: including those involved in the development of systematic conservation planning
- Conservation by design: developed by TNC, using a five-step process (identifying targets, gathering information, setting goals, assessing viability, assembling portfolios) and the 5-S framework (systems, stresses, sources, strategies, success)

There are many other examples; a selection are available on the Web-based Earth Conservation Toolbox.[83]

3.2. Protect, Manage, Restore

WWF[84] and IUCN have developed a number of landscape approaches to help address this kind of broadscale decision making, and these or similar exercises could provide help in determining where restoration could be used most effectively. An outline of one approach is shown diagrammatically in Figure 7.1 (also see Box 7.1 for the detailed steps):

3.3. Implementing Conservation in Priority Areas

WWF also has a science-based methodology for continuing ecoregion planning inside priority conservation landscapes, containing a set of guidelines to develop and implement a conservation landscape, which could be used to include restoration issues.[85]

3.4. Reference Forests

Restoration for conservation usually involves trying to regain something as similar to a native forest as possible (for more, see "Identifying and Using Reference Landscapes for Restoration").

[83] www.earthtoolbox.net.
[84] Aldrich et al, 2004.
[85] Loucks et al, 2004.

Box 7.1. The stages in a protect–manage–restore process

- ✓ Defining our own conservation targets: As stakeholders, conservation organisations need to start with some ideas of the landscape mix that they are aiming for, including ideas about geographical areas and ecological processes of primary interest. Reaching these targets will require a mix of protection, management, and restoration.
- ✓ Learning about the needs and expectations of others: At an early stage it is important to get an initial idea about the other key stakeholders and their relationships, what they need and want, and what they are planning. While the focus will be on economic or development issues, culture, history, expectations within society, level of development, and spiritual needs are all important.
- ✓ Defining the landscape(s): The concept of "landscape" has many different meanings; a conservation programme will usually work within a predetermined "conservation landscape," but it is important to identify any "cultural landscapes" nested within or overlapping the conservation landscape: e.g., a village, land used by nomadic pastoralists, or a timber concession.
- ✓ Assessing current/potential benefits from the landscape: The next stage involves assessment to identify lost, current, and potential future values from the landscape. While conservationists tend to focus on biodiversity, assessment also takes full account of social, cultural, and economic values. The extent to which this is a *participatory process* can be decided on a case-by-case basis. Including stakeholders also means that assessment is part of the negotiation process.
- ✓ Developing land-use scenarios: Integration of potential conservation and development actions to develop scenarios including a combination of elements such as protected areas; other protected forests (set asides, watershed protection etc); well-managed forests; areas needing restoration; and other compatible and competing land uses. All these factors interact. What mosaic will work best? Are we looking at one "master plan" or a pattern that emerges gradually over time?
- ✓ Reconciling land use options: The approach is predicated on the idea that trades-offs among social, economic, and environmental values are often essential and are acceptable if overall values are maintained or enhanced within the landscape.
- ✓ Decisions: In some situations government(s), nongovernmental organisations, corporate interests, and communities may agree on a package of actions within one action plan. In many other cases, negotiations are likely to be continuing and sporadic. Here it is unlikely that a single master plan could be agreed; rather, decisions will be over smaller parcels of land within a framework that will continue to evolve.
- ✓ Implementation (strategic interventions): Some of the resulting actions will take place at the site level and may involve creating the right conditions for natural regeneration, selective tree planting to reconnect forest fragments, or community initiatives to improve fire management. Other interventions may be necessary at a landscape or even larger scale, e.g., working with governments to realign reforestation programmes.
- ✓ Monitoring and learning: Much of what we will be attempting with the landscape approach is quite new, and therefore it is especially important to ensure that progress is monitored effectively and that

lessons are both used to improve programmes as they develop and are also transmitted around and beyond the immediate conservation programme. At a larger scale, combining monitoring of many individual projects, along with some additional indicators that transcend individual project work, will be needed to measure progress over the whole landscape.

3.5. Gap Analysis

Several methodologies exist for identifying gaps in existing forest systems. For example, a WWF Canada methodology used enduring landform features to identify likely past vegetation,[86] while another developed by the United Nations Environment Programme-World Conservation Monitoring Centre(UNEP-WCMC) used analysis of current forest cover.[87]

4. Future Needs

Although restoration needs are increasingly being addressed within broader-scale conservation, they generally remain less well supported in terms of approaches and methodologies than, for example, planning of protected areas. These needs include the following:

Prioritisation: There is a need for better tools for prioritisation of areas for restoration, for example to balance the importance of connectivity with core areas, identification of microhabitat gaps in current forest cover, calculation of minimum viable areas, etc.

Decision support: Methodologies are needed for balancing social and ecological values, including participatory methods.

Incorporating a range of management schemes into existing decision support tools: Currently, decision support tools consider an area either protected, or not, based on the input of the user. More sophisticated tools are needed that can handle a wider range of “protection” schemes (e.g., sustainably managed forests).

There is also the need for some degree of advocacy and explanation, to encourage those involved in broad-scale planning to consider restoration, particularly in the case of restoring forest quality. Some of these tools are being developed during current forest landscape restoration projects, but it is still too early to judge their success.

[86] Iacobelli et al, 1994.
[87] UNEP-WCMC, 2002.

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8
Addressing Trade-Offs in Forest Landscape Restoration

Katrina Brown

Key Points to Retain

In questions of land management and natural resource allocation it will nearly always be impossible to satisfy all stakeholders and there will necessarily be winners and losers.

Applying the concept of multifunctionality can help to allow different forest functions to coexist, meeting a wider range of different stakeholder groups' interests.

Capacity needs to be created among conservationists to engage stakeholders in constructive trade-off discussions and to deal with the outcomes of these.

1. Background and Explanation of the Issue

In most of the places where forest restoration is being considered, from the perspective of either conservation or development, the landscape is already inhabited. Furthermore, the resident or transient populations are unlikely to be a single homogeneous entity. Therefore, forest restoration involves many different stakeholder groups with their own wants and needs.[87a] Agreeing what the restoration priorities should be within a given landscape will consequently necessitate negotiating trade-offs among a range of stakeholders.

[87a] Sheng (no year).

1.1. Win–Win Situations

It is often assumed that with enough discussion and compromise, questions of land management and natural resource allocation can be agreed to in ways that satisfy everyone—in this case that a sufficient number and variety of forest functions can be restored in a landscape to satisfy all stakeholder groups: so-called win–win situations. The question of how to attain such win–win situations has been addressed by many integrated conservation and development projects, and the consensus seems to be that in most real-life situations it will be impossible to satisfy everybody and there will necessarily be winners and losers.[88] From our perspective, some people will stand to gain more from the restored functions of a forest, for example with increased availability of fuelwood or salable products, while others will lose for instance, through access or grazing rights. The realistic aim of a negotiated process is to minimise the losses and to ensure that these do not fall disproportionately on those already amongst the poorest or otherwise disadvantaged. Indeed, raising false assumptions that careful planning and participatory processes can deliver win–win results, and an accompanying failure to deal with necessary trade-offs are often major sources of conflict, because people have their expectations raised and then not met.

[88] McShane and Wells, 2004.

1.2. Identifying Stakeholders

The need for trade-offs arises because different stakeholder groups have different expectations or needs from a landscape. To understand trade-offs when dealing with a restoration programme in a landscape, the first step is to identify all the stakeholders. Often stakeholders are characterised by their degree of influence and importance.[89] The results of such an analysis can be categorised into primary stakeholders, secondary stakeholders, and external stakeholders. Primary stakeholders have little influence on the outcomes but they have the most to lose from management decisions. A primary stakeholder could be a farmer, a fisher, or a forest-dweller. Secondary stakeholders are often managers or decision makers, and they are the ones charged with implementing the decision, although the outcomes do not impact directly on them. External stakeholders are those who can significantly influence the outcome even if they are located far away, typically international nongovernmental organisations (NGOs). Many more complex stakeholder categories have been suggested, but these three capture the main groupings. Depending on the objectives of the trade-off process, stakeholder analysis can be critical in identifying *who* to include and perhaps *how* to engage them.

1.3. Brokering a Satisfactory Outcome

The next requirement in an equitable trade-off process is to allow genuine discussion on trade-offs between different stakeholders. There is usually a need for someone to help facilitate this process, ideally a person without a stake (perhaps a trusted outsider) who can act as an "honest broker."[90] The role of the broker is to encourage an open discussion and to help facilitate a process whereby different stakeholders feel that they are gaining something from the process, even if that may mean also agreeing to some sacrifices. For instance, shifting cultivators may need to modify their approach to farming, but in return they may gain legitimate access to nontimber forest products located in the landscape. Frequently, conservation or development organisations like to consider themselves as "neutral brokers," yet the reality is that they also have a position and an interest. Conservation organisations are stakeholders just like any other, with a particular vision that will sometimes be in competition with other legitimate economic and social "visions," and conservationists are therefore unlikely to get everything that they want.[91] "Valid processes require much more time, patience and sensitivity to local cultures than most outside experts are prepared to allocate. Neutral facilitation and explicit recognition of the trade-offs between the interests of different stakeholders are important ingredients of success."[92]

1.4. The Concept of Multifunctionality

When negotiating trade-offs in attempting to restore forest functions in a landscape, the concept of "multifunctionality" is important. If one stakeholder group, for instance biologists, is the only one deciding on the restoration outcomes of a given landscape, it may be that an ideal landscape for that group is one containing pristine habitat for all identified species in the given area. On the other hand, if the single stakeholder is a plantation company, it may be that its vision for the main function to restore in the landscape is that of productive monoculture plantations bringing in money from pulp and paper. For a poor local family, the main function it may be interested in restoring might be fuelwood. Applying the concept of multifunctionality can help to allow these different functions to coexist, meeting a wider range of different stakeholder groups' interests.

1.5. Types of Trade-Offs[93]

Restoring a landscape intentionally to meet a range of functions requires negotiating trade-offs. There are different types of trade-offs:

[89] Brown, 2004.
[90] Franks, 2004.
[91] Aldrich et al, 2003.
[92] Sayer et al, 2003.
[93] Brown, 2004.

- Trade-offs between different interest priorities, as per the example above
- Trade-offs between short and long-term horizons
- Trade-offs between different spatial scales, notably sites and landscapes
- Trade-offs between different sections of society and biodiversity conservation, typically farmers or plantation owners and conservation NGOs
- Trade-offs between different aspects of biodiversity, as it may not always be possible to restore a landscape to secure all species in a landscape; decisions on which species will take priority will require trade-offs
- Trade-offs between different social groups—traditionally more influential groups may have taken decisions, but primary stakeholders are those whose livelihoods are directly affected; in a truly representative process, trade-offs will need to happen across social groups and scales.
- Trade-offs among economic priorities, social welfare, and conservation.

The skills needed to assess and evaluate such trade-offs and support negotiations about them are often lacking amongst conservation organisations, although they are more likely to exist within aid or development bodies. Developing negotiating skills is one of the key priorities in developing the capacity to work at landscape level (see "Negotiations and Conflict Management").

2. Example: An Hypothetical Example for Negotiating the Restoration of a Landscape

There are as yet few examples where a truly negotiated discussion and trade-offs led to a restored landscape.

A theoretical process to achieve this was presented at a workshop in Madagascar.[94] Possible steps to reach a negotiated outcome for a restored landscape are as follows:

Each stakeholder group describes the landscape as it was 50 years ago, the steps that turned it into the current landscape and the main drivers of the changes.

A facilitated discussion takes place to negotiate the general state of the landscape and its possible future state(s) (characteristics, products, and services it could offer, etc.).

Each group develops a precise and detailed vision for the landscape 10 years from the present, identifying the most important characteristics (i.e., the nonnegotiables), categorising the possibly negotiable characteristics and the definitely negotiable characteristics.

The visions of different groups are then placed side by side, and a negotiation process begins that will culminate in a common vision for the future, restored landscape, that is acceptable to all.

Such a process most certainly takes a significant amount of time. It requires clear identification and representation of stakeholders, a genuine neutral broker (or group of brokers), and different tools and processes to allow each stakeholder group to understand the implications of different decisions.

3. Outline of Tools

Some of the tools available to allow the negotiation of trade-offs are as follows:

3.1. Focus Groups

Working in small groups builds confidence, especially amongst stakeholders who may be reluctant to air their views in large meetings or are not used to public speaking. It enables specific stakeholders to rehearse and deliberate in a safe structured environment, prior to larger meetings or workshops.

3.2. Surveys

Surveys can be valuable in generating baseline data and information to build believable scenarios or visions of the future and to illustrate management options. They are a means to learn about and approach different stakeholders. A particularly useful contribution is to feed back information generated from surveys to stakeholders as part of a social learning and triangulation process.

[94] Taken from a presentation by Tom Erdmann given at a workshop on Forest Landscape Restoration in Madagascar in March 2003.

3.3. Consensus Building Workshops

Different stakeholders may be brought together in workshops to negotiate trade-offs and agree on management strategies. A range of conflict resolution and consensus building techniques can be used, including visioning and scenarios, as well as ranking and voting on criteria and scenarios.

3.4. Multicriteria Analysis

Multicriteria analysis is a decision-support tool that can be used in a sophisticated and data intensive way or, in deliberative workshops, as a means to help stakeholders take a step back from concentrating on outcome to assess what criteria should guide decisions. Rather than discussing the outcomes of management, this forces people to look at *why* and *how* decisions should be made rather than on the impacts of the decisions. This aids a more consensus-based approach to negotiations.

3.5. Extended Cost-Benefit Analyses

A range of evaluation techniques can be used to draw attention to the nonmonetary and noneconomic impacts of different management options and to learn about how different stakeholders value the multiple functions of resources. Again it can help to validate and build confidence in stakeholders by recognising their priorities and values.

3.6. Scenario-Building

A useful way to discuss different options without them being directly linked to interests of specific stakeholders is to define scenarios or coherent, internally consistent, and plausible descriptions of the future. These must be believable and understandable to all stakeholders and must be linked to specific changes. Discussing and evaluating scenarios are a way of talking about management options without having to argue against one person's project or strategy, and therefore can be useful for building consensus.[95]

4. Future Needs

Evaluating and negotiating trade-offs is rarely part of conservation projects, let alone restoration ones. Much more practical experience is needed in negotiating trade-offs when looking at restoring forest functions in a landscape. This is particularly the case when considering limited resources and the urgency of some restoration needs. In other words, how does one balance a truly participatory trade-off analysis with urgent needs to restore habitat for a threatened species?

Capacity needs to be created among conservationists to engage stakeholders in constructive trade-off discussions and to deal with the outcomes of these.

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[95] Brown et al, 2002.

Part B
Key Preparatory Steps Toward Restoring Forests Within a Landscape Context

Section IV
Overview of the Planning Process

9
An Attempt to Develop a Framework for Restoration Planning

Daniel Vallauri, James Aronson, and Nigel Dudley

Key Points to Retain

While no two restoration experiences will follow the same pattern, indicative steps to planning a restoration initiative are important, particularly when dealing with large scales or landscapes.

Success depends on wise planning, balancing short-term with long-term goals, and allocating the funding available for the restoration programme as efficiently as possible.

Learning from past restoration programmes and their successes and failures is an important starting point to help plan better restoration actions in the future.

There are few tools dealing with planning restoration in large scales. A five-step logical planning process is being proposed.

1. Background and Explanation of the Issue

1.1. Why Planning?

Restoration of natural systems is a difficult, energy-consuming, and expensive undertaking. It is almost always a long-term, complex, and transdisciplinary process.[96] This is particularly true when dealing with highly degraded ecosystems and landscapes. Inevitably, conflicts of interest and other problems arise.

Ecologically speaking, the restoration of highly degraded forest usually requires initiating an embryonic ecosystem within a few years (usually less than 10 to 15 years after degradation), which will be only fully restored—very often after additional corrective or fine-tuning interventions—after a period of at least 50 years in the tropics, and of 100 years or more in the extratropical zones. However, forest policies and restoration programmes are generally financed only on a short- to medium-term basis. A 10- to 15-year project span, in most cases, is the longest possible perspective, both for political and financial reasons. Bearing this in mind, restorationists should (1) adapt short-term restoration goals and techniques to minimise the number of costly corrective actions; and (2) plan ahead to secure funds for carrying out monitoring and evaluation, corrective actions, or "aftercare" in the long term.

Also, forest restoration requires inputs and expertise from various academic and practitioner fields[97] like ecology, silviculture, economics, public policy, and the social sciences, which need to be combined in an efficient way.

Meanwhile, the relative lack of experience with broad-scale conservation means that filling the knowledge gaps through research programmes also takes time. Five to 10 years is the minimum period needed to investigate critical

[96] Pickett and Parker, 1994.

[97] Clewell and Rieger, 1997.

questions like natural dynamics, nursery and plantation techniques for native species, etc. However, very little money is available to finance pure research programmes unless they can be linked to real implementation and visible successes in the field. Bearing this in mind, restorationists should define short-term goals and activities that get restoration underway, along with long-term goals for how it can be sustained over the time period required. A critical, pragmatic aim is to achieve at least some rapid field results, for example on carefully selected pilot sites, to build support for longer term efforts.

Finally, forest landscape restoration, as developed in this book, requires a concerted approach among stakeholders and communities, to develop a shared and accepted vision and goals for the future of the landscape in question. This also takes time and should be planned for, but at the same time should lead rapidly to tangible changes or outcomes that really engage stakeholders and people living in the region in a lasting and meaningful manner.

Success in forest restoration depends on wise planning,[98,99] both in time and in space, balancing short-term goals with long-term goals, and allocating the funding available for the restoration programme as efficiently as possible. Accordingly, a clear step-by-step plan of action is needed for success. This was very often lacking in past restoration programmes, especially site-oriented ones, and has led to many failures or difficulties that often emerge only decades after the first restoration efforts were begun.

1.2. Restoring Step by Step

Where restoration is to be carried out as part of a wider conservation effort, at the landscape or ecoregional levels, we would propose that it be planned as an embedded element within an integrated programme that also involves protection of whatever is left of untouched nature, and the promotion of good ecosystem management, as guided by the principles of stewardship, sustainability, and sustained use. We have already outlined some possible elements in a protect–manage–restore programme in the introduction to this book. This approach includes identifying a series of conservation targets—in this context, what forest functions we wish to restore—and “reconciling” these with the needs, tastes, and expectations of other stakeholders, especially the indigenous populations.

Conceptualisation of the process of implementing restoration programmes is very new. We propose below an outline of a planning framework, following a five-step logical planning process. In the context of a broad-scale conservation strategy, then, the following steps help lead to the development and realisation of restoration achievements.

1.2.1. Step 1: Initiating a Restoration Programme and Partnerships

An essential first step of any forest landscape restoration programme is the identification of the problem being addressed and agreement on the solutions and the targets for restoration. Such targets should ideally contribute to wider ecological and socioeconomical objectives at a landscape scale. Very often, restorationists must start from zero to raise awareness on the state of degradation in the landscape, analyse the root causes, and then convince other stakeholders of both the need for and the feasibility of forest restoration. Depending on the context (the existing level of awareness, politics, funds available, etc.), this step could last for several years and require extensive effort.

Experience suggests that restoration usually only works in the long term if it has support from a significant proportion of local stakeholders. Finding out the needs and opinions of stakeholders is therefore important: What forest functions do they want to restore and are there potential clashes of interest? It should be recognised that the restorationists (conservation NGO or other) are themselves stakeholders with a particular interest (i.e., restoring biodiversity), which may need to be reconciled with other stakeholders’ priorities.

[98] Aronson et al, 1993.
[99] Wyant et al, 1995a,b.

Outputs of this step are:

- recognition and common understanding of the degradation, root causes, and solutions;
- stakeholders' involvement and participation;
- partnership development for an efficient restoration programme (written key ideas of the programme and memorandum of understanding); and
- secured budget for the restoration programme for at least a first pluri-annual period (e.g., five years).

1.2.2. Step 2: Defining Restoration Needs, Linking Restoration to Large-Scale Conservation Vision

Here is a step that is not necessarily easy to "sell" to local stakeholders. The geographical scope can be much wider than many people are used to working with or even conceptualising (or want to work with, as it has some implications for development, too). Ideally, as mentioned above, a vision and strategy for restoration should be developed within an integrated "protect–manage–restore" approach, especially because the investment needed to restore has to be reinforced through synergy with management and protection activities.

Assessment is needed to determine how restoration targets might be achieved, including determining current or potential benefits from forests in the landscape (biodiversity, environmental services, and resources for subsistence or sale) and the potential for restoration through use of reference forests and other techniques. An important part of the process is deciding the realistic boundary of the area or areas that we wish to restore. Definition of key areas for protection, analysis of degradation, and the predictive anticipation of threats can all help to define priority landscapes where investment in restoration is most justified.

Outputs of this step are:

- definition of conservation targets at various pertinent scales (ecoregion, landscape);
- analysis of the broad consequences on the landscape of past degradation, active pressure, and potential threats;
- definition of the role of restoration along with identification of protection and management needs; and
- identification of the priority areas that require restoration and explanation of the reasons why: Which landscapes, landscape units, or landscape functions do we need to restore? Which species do we need to eradicate, control or reintroduce?

1.2.3. Step 3: Defining Restoration Strategy and Tactics, Including Land-Use Scenarios

Considering ecological characteristics, but also socioeconomical context or goals assigned to the restoration project, several trajectories and restoration options could be developed for the same project. Choosing among these options requires careful study and data gathering.

This will necessarily mean reconciling different points of view and opinions. Agreement can be a phased and continuing process; that is, it may be possible to agree to some specific and useful restoration interventions without reaching agreement about the whole future of the landscape. The way in which such agreements are reached will naturally depend on the political and social realities of particular countries or regions; the general principle that decisions should be as participatory as possible applies throughout.

Outputs of this step are:

- assessment of current/potential benefits from the landscape for people, and for biodiversity;
- assessment of the current, past, and reference landscape states;
- definition of what we can expect to restore;
- development of possible land-use scenarios in space (including maps);
- development of possible restoration trajectories to achieve short-term and long-term goals (including models, time frames, and maps);
- reconciliation of land-use options: how can we achieve specific goals while meeting or reconciling conflicting demands, tastes, and needs?;

- set of goals, strategies, and tactics for each zone and problem in the landscape;
- set of priorities in space and time;
- identification of restoration trajectories, technical options, steps, and phases, (especially remembering the monitoring and "fine-tuning" phases necessary to fully achieve long term restoration goals); and
- A written restoration plan, strategy, and set of tactics, with identified time frames, maps, allocated funds, and quantified targets.

1.2.4. Step 4: Implementing Restoration

This step is the most visible part of the work, and usually the most costly. Some projects start here, for example, by directly investing all the available funds to plant trees on an emblematic or strategic site. However, this ignores the previous planning steps recommended above and can easily end up wasting time and resources in restoration activities that either do not work or are in suboptimal locations. It is of course judicious to start small-scale actions, such as one or more pilot sites, for the sake of "learning by doing," to demonstrate the feasibility of key restoration goals and to test silvicultural techniques (for example planting, but also natural regeneration). But we would strongly recommend that larger scale activities also be undertaken in the context of careful planning and assessment as outlined in steps above.

Outputs of this step are:

- development of pilot sites;
- implementation of large-scale actions;
- lessons learned from first results, both successes and failures; and
- design and implementation of changes/ adaptation in the restoration programme.

1.2.5. Step 5: Piloting Systems Toward Fully Restored Ecosystems

In practice, a few years or decades after starting implementation, even if restoration has hitherto been successful, unexpected results of previous work or changing circumstances (evolution of the socioeconomic context, for example) could alter the most preferable restoration trajectory. This could even lead in some cases to redefining overall project goals. Such modifications should not be considered as a failure of the overall programme, but rather as a normal step in the restoration of a complex set of ecosystems within a larger landscape matrix.

Thus, the restoration work is not "finished after planting." To sustain restoration success in the long run, and to anticipate potential problems, a simple monitoring and evaluation framework (see section "Monitoring and Evaluation") needs to be set up from the outset of the programme in order to facilitate adaptive management and corrective actions.

Outputs of this step are:

- regular evaluation (social, economical, ecological);
- restoration trajectory reappraisal; and
- design and implementation of corrective actions.

2. Examples

As yet, there are few full-scale forest landscape restoration programmes, although their numbers are rapidly increasing. The following examples show both the need for planning and broad-scale restoration planning in practice. These examples show not only how a planning framework can be implemented, but also how problems can arise by forgetting one step.

2.1. New Caledonia: From Awareness to Restoration of Tropical Dry Forests (Step 1)

It took 15 years from the first alarm signals by scientists to the first significant pilot plantings or protection of sites within a forest landscape restoration initiative in New Caledonia. Attention to the tropical dry forests of New Caledonia began to grow in the early 1990s. In 1998, WWF, the global conservation organisation, launched an effort to organise a consortium of research institutions, local government agencies, and NGOs (10 partners) to create a tropical dry forests programme. Underway since 2001, this programme has already carried out much of the preliminary reconnaissance and mapping in different tropical dry forest fragments, as well as ecological, silvicultural, and horticultural studies of great importance to restoration efforts slated to begin in the field in 2005. Two of the authors (Aronson and Vallauri), who have been involved in this restoration programme, consider that partners should work to prepare now as soon as possible a protect–manage–restore approach and restoration at broad scale in a large priority landscape, like the ecologically outstanding landscape of Gouaro Deva (see "Restoring Dry Tropical Forests").

2.2. Vietnam: Integrating Restoration into a Landscape Approach Across Seven Provinces (Step 2)

The Central Truong Son initiative, covering seven provinces in central Vietnam inland from Dalat, is developing an integrated approach to forest protection, management, and restoration. Comparatively large areas of natural forest remain standing, although often in poor or highly degraded condition. There are major plantation developments of varying success, and the government is committed to maintaining protected areas. The new Ho Chi Minh Highway is bringing rapid social and environmental changes, some of which directly threaten remaining natural forests. The Central Truong Son initiative has identified priority landscapes and used a gap analysis, coupled with a detailed study of forest quality, to pinpoint the most effective areas for restoring natural forest in terms of increasing forest connectivity and protecting biodiversity; these are currently around the buffer zone of Song Thanh nature reserve and in a so-called green corridor area linking several patches of natural forest. Elsewhere, more generally the project is seeking to increase the proportion of forest restoration funds used for natural regeneration (see case study "Monitoring Forest Landscape Restoration—Vietnam").

2.3. France: The Consequences of a Lack of Ecological Monitoring (Step 5)

In the early 1860s, an ambitious "Restoration of Mountain Lands" initiative was set up by the French forest administration in the southern Alps, primarily for the purpose of erosion control. A wide range of plant material was used, including native shrubs and grasses, but no particular preference was given to native trees for replanting. Over 60,000 hectares were thus planted between 1860 and 1914, using mainly *Pinus nigra* Arn. subsp. *nigra* Host. These efforts have proved effective at stopping the average erosion rate (of 0.7 mm per year) on black marls. Nevertheless, although rehabilitated in the sense that erosion has been halted and badlands forested, these ecosystems were not fully restored. No fine-tuning assistance and ecological evaluation was carried out until recently.[100] The forest soils were now better protected, as shown by the study of soil biological activity, especially earthworm communities. However, the rehabilitated ecosystems were facing two new ecological problems: lack of natural regeneration, and development of an infestation of the pine trees by mistletoe (*Viscum album*). Once management priorities have been revised, the goal for the future is to restore the diversity, structure, and functioning of a native forest ecosystem. The absence of long-term monitoring and evaluation for about 100 years did not allow a rapid adaptation of the restoration trajectory. After a necessary short pioneer stage with Austrian pine, the restoration strategy should have been pursued 30 years later by a phase of autogenic restoration of native biota [oak (*Quercus*), maple (*Acer*), mountain ash (*Sorbus*), and others].

3. Outline of Tools

There are still few specific planning tools designed specifically for restoration. However, many existing conservation planning tools could be adapted for or could include a restora-

[100] Vallauri et al, 2002.

tion component. For example, Conservation International has developed guidelines for corridors that include reference to restoration to fill gaps in existing forest cover, although with little detail.

The reader will find more details on the potential tools step by step in the following sections. They include among others:

Step 1. Initiating a restoration programme and partnerships
- Lobbying
- Participatory approaches
- Capacity building

Step 2. Defining restoration needs, linking restoration to large-scale conservation vision
- Ecoregional planning process (WWF)
- 5-S process and systematic conservation planning (The Nature Conservancy)
- Landscape planning

Step 3. Defining restoration strategy and tactics, including land-use scenarios
- Conceptual modelling
- Geographic information systems
- Ecological modelling
- "Restoration vision and strategy" meetings

Step 4. Implementing restoration
- Tools on plantation, natural regeneration, species' selection, etc., are covered in other sections of this book.

Step 5. Piloting systems toward fully restored ecosystems
- Restoration projects' databases: A lot could be learned from past restoration successes and failures. The analysis of databases of long-term restoration projects is very useful, like the world restoration database launched by UNEP-WCMC (http://www.unepwcmc.org/forest/restoration/database.htm) or the database of evaluated restoration programmes in the Mediterranean (http://www.ceam.es/reaction/)
- Criteria and indicators for monitoring (see section "Monitoring and Evaluation")

4. Future Needs

Restoration planning in landscapes or large scales is still in its infancy. Much further work is needed to refine and improve the planning process and define appropriate tools. Thus, specific work on restoration planning is highly needed in the coming years, both in theory and in practice. Learning from past restoration programmes and their successes and failures could prove an efficient starting point. In time, lessons might usefully be captured in a step-by-step guidebook or manual specifically on this subject and perhaps with associated software programmes if appropriate.

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Section V
Identifying and Addressing Challenges/Constraints

10
Assessing and Addressing Threats in Restoration Programmes

Doreen Robinson

Key Points to Retain

Threats may be direct, indirect, or potential. Before undertaking a large-scale restoration effort, it is important to understand threats in all three categories.

A variety of tools for undertaking threat assessment and integrating the results into forest restoration programmes have been tested around the world. In most cases, tools will need to be used in conjunction with others or may need to be modified to fit local circumstances.

A key challenge for restoration programmes is to expand the breadth of expertise integrated into assessment and analysis through multidisciplinary teams.

1. Background and Explanation of the Issue

The key to any successful restoration programme lies in good project design that is based on sound science, a thorough understanding of threats and opportunities, and a strategic and pragmatic suite of interventions chosen to mitigate identified threats while capitalising on key opportunities. A comprehensive threat assessment goes beyond merely identifying the factors, behaviours, and practices that pose a challenge to forest restoration, but includes an analysis of the underlying social, economic, and political incentives that drive such behaviours.

1.1. Information Needed for Threat Assessment

For restoration programmes, a good threat assessment provides actionable information that can be used to define the scope of interventions. Information should be timely, verifiable, and collected in a cost- and time-effective manner. Restoration programmes are not immune to the all too common pitfall of investing considerable time and resources in collecting a tremendous amount of data that, while perhaps new and interesting, is not particularly relevant to making decisions about the best way to undertake restoration activities. To avoid this pitfall it is often useful to frame a threat assessment by exploring different types of threats—direct, indirect, and potential.

1.2. Types of Threats

Direct threats are those with immediate and clear causal links to the negative impact of forest degradation or loss. Indirect threats, often referred to as root causes,[101] are the underlying drivers behind direct threats. Potential threats are those threats that, while currently not posing a significant challenge to forest restoration, have the potential to under-

[101] Wood et al. 2000.

mine such investments in the future. Given that forest restoration is a necessarily long-term conservation intervention, it is important to include such a temporal component in threat analysis.

For restoration programmes around the world a number of common direct threats have been identified, including habitat fragmentation, unsustainable use, and overharvesting of forest resources, pollution, and invasive species—all contributing to the breakdown of ecological processes that are critical to the healthy functioning of natural forest systems.

Underlying drivers of such threats are often related to policies that favour rapid and unsustainable conversion of forests for short-term economic gains. Markets for forest products, including global markets for products like timber and palm oil or local markets for fuelwood, can drive forest degradation and loss, particularly when market dynamics externalise true costs.

Persistent conflict and civil unrest may force local dependence on forest resources to expand rapidly, given both a lack of alternatives to meet livelihood needs or an influx of migrants and displaced persons fleeing from conflict zones into forest areas. Moreover, in many cases, forest resources are the only resources readily available to generate the cash necessary to continue such conflicts. In such situations, the prospects for successful restoration are limited if underlying governance and conflict issues are not addressed.

Other common indirect threats to forest restoration include a lack of knowledge and skills regarding the science and research behind appropriate habitat restoration and a lack of technical capacity to implement activities on the ground. A lack of political will and broad stakeholder support for restoration activities plagues many restoration programmes worldwide. Such a lack of support is often tied to a perception of high transaction costs or limited benefits associated with undertaking restoration. Given the time frame required for restoration projects, both a lack of sustained financial resources and unsure resource and land tenure rights combined can create a strong disincentive for undertaking restoration activities.

2. Examples

2.1. Madagascar

In southern Madagascar the U.S. Agency for International Development is partnering with the Communes of Ampasy-Nahampoana and Mandromodromotra, the Department of Water and Forests (La Circonscription des Eaux et Forêts–CIREF) and QIT Madagascar Minerals (QMM) to undertake forest restoration activities in the Mandena Conservation Zone. The region's forests are highly fragmented as a result of extraction of forest resources to meet the rising fuelwood needs of a growing population and increasing slash-and-burn agriculture, among other threats. This is one of the poorest regions of Madagascar, and the reliance of local populations on the forests to meet livelihood needs is driving forest loss and degradation.

A thorough understanding of the threats and opportunities of this region identified by QMM in collaboration with the communes, community leaders, and regional government representatives produced a diverse set of innovative activities intended to mitigate direct threats of forest fragmentation and indirect threats associated with poverty. For example, in exchange for rights to mine ilmenite across the region—intended to stimulate economic growth and generate income within the region—QMM has agreed to invest in forest restoration in blocks adjacent to existing protected areas of primary forest harbouring significant biodiversity. The restoration will not only expand the area of contiguous forest, but also improve the health of the forest, protect critical water cycling processes, and is also tied to investment and development of ecotourism in the region. To mitigate deforestation of remaining intact areas driven by increasing local demand for fuelwood and charcoal, plantations of fast-growing species on already degraded or deforested land are also being supported.

Even with a solid understanding of threats, the ability to address forest restoration, biodiversity, and local development needs in southern Madagascar is certainly not without challenges. A lack of knowledge and capacity in local forest ecology made the identification of relevant native pioneer species a significant challenge, requiring over 8 years of research and a multimillion dollar investment to develop appropriate protocols for forest restoration. Perhaps the greatest challenges faced by partners now are how to scale up interventions beyond initial target restoration sites and to engage new collaborators in order to effectively address the true magnitude of threats driving forest degradation and loss across the entire region.

2.2. Atlantic Forest in Argentina

In the Andresito region of Misiones, Argentina, Fundación Vida Silvestre Argentina (FVSA) and WWF are helping to restore key areas of forest adjacent to the Green Corridor, the largest remaining area of contiguous Atlantic forest in the world. The area has been significantly deforested by rapidly growing human populations to support small-scale agriculture and meet human fuelwood needs.

To develop a detailed restoration strategy for the region, FVSA undertook a thorough analysis of threats and opportunities, combining on-the-ground surveys, economic analyses, and GIS tools. FVSA began by developing detailed land use maps for each parcel of land in the region based on the current tenure. Detailed land use maps were then overlaid with biological and socioeconomic data to identify key opportunities for creating forest restoration corridors that could meet overarching forest restoration goals. Research on biodiversity-friendly production practices for local forest and shade products was also undertaken with several universities in Argentina to assess potential economic gains from alternative conservation friendly enterprises. Pilot restoration plots using different species and production techniques were established to assess both ecological and economic costs and benefits (also see case study "Finding Economically Sustainable Means of Preserving and Restoring the Atlantic Forest in Argentina"). With poverty on the rise in the region, alternative income generation opportunities are a critical incentive for landowners to begin undertaking forest restoration.

Armed with these analyses and research results, FVSA continues to engage in a participatory process with individual private landowners, local cooperatives, government representatives, and others to develop appropriate long-term land use management options that include a mix of reforestation, timber harvesting, nontimber forest product production, and other uses. By including a spatially explicit component of such land use management plans, stakeholders are continuously able to see not only how restoration practices benefit them, but also how they are contributing to a broader sustainable vision for the entire region. Currently, the major challenge for this project also involves scaling up. FVSA is focussed on helping stakeholders expand the adoption of new production alternatives, sustainable resource use management practices, and developing carbon credit schemes to mitigate high restoration costs in order to achieve restoration goals over the long term.

2.3. Using a Three-Dimensional Model to Identify Threats in Vietnam

In the area surrounding the Song Thanh Nature Reserve in the Quang Nam Province of Vietnam, WWF and partners undertook a participatory landscape planning process with community members from nine villages.[102] A "papier-mâché" 1:10,000 model of the 30,000-hectare landscape surrounding the reserve was used to facilitate planning and decision making amongst villagers and forestry sector employees.

Using paints, pins, and yarn to depict land use, natural resource elements, threats, and relationships, animated discussions and debates helped inform an integrated management plan focussed on a suite of protection, management, and restoration activities. In particular, through the modelling process, threats from illegal gold mining activities were identified and hotly debated, and have been raised with relevant authorities. Elderly people, women, and children were all able to contribute to the model-

[102] Hardcastle et al, 2004.

ling exercise, facilitating broader community involvement in decision making and buy-in for the planning process. While the three-dimensional (3D) mapping of threats provided a good way to engage communities in restoration planning, solid facilitation and conflict resolution skills were critical in ensuring success. This relatively cost-effective activity is now being replicated in other areas in the region in order to develop an integrated land and resource management plan at a larger landscape scale.

3. Outline of Tools

A variety of tools for undertaking threat assessment and integrating such analysis into forest restoration programmes have been tested around the world. While no one tool is ideal for all situations, certain aspects are useful for programme implementers to consider when selecting and modifying existing tools to meet specific forest restoration goals, including stakeholder participation, flexibility/adaptability of analysis, costs (e.g., time, human resources, financial resources, etc.), iterative nature of information gathering and analyses, processes to include new and updated information, communicability of outputs to appropriate audiences, and ability to incorporate different types of data (i.e., qualitative vs. quantitative).

Research studies, literature reviews, ecological and socioeconomic surveys, focus groups, and key informant interviews are all techniques that are used to gather relevant information needed to undertake threat analyses. A number of tools can be used, singularly or in combination, to carry out the actual analysis.

Conceptual modelling[103] is commonly used to show linkages and complex relationships between threats and their impacts while providing a strategic framework for thinking about appropriate project interventions. Conceptual models explicitly identify the restoration factors that programmes are intended to influence while characterising both direct and indirect forces affecting these factors. Conceptual models are particularly good for teasing out root causes, integrating interdisciplinary perspectives and are generally supported by a mix of quantitative and qualitative background data. They can be quite participatory if multiple stakeholders are brought in as part of facilitated discussions. However, conceptual models can get very complex and make it challenging to identify and prioritise interventions.

Threat matrices are a useful way to link threat assessment to project goals and specific activities. Matrices can vary from relatively simple to complex logframes where forest restoration targets are explicitly stated, with relevant threats, activities, and potential indicators for monitoring change over time explicitly tied to these targets. Matrices are good for tying threat analysis to specific activities and strategic interventions and are easily updated as adaptive management is practised. The underlying assumptions linking threats to targets and activities can be obscure and should be explicitly stated and supported by both qualitative and quantitative analysis.

Threat mapping[104] can be used to assess threats for a forest restoration area—in the form of either a pictorial map or 3D models made out of clay, wood, or other materials (see above example in Vietnam). These maps are the basis for discussion of changes in forest habitat quantity or quality, often with community groups. The process involves facilitated discussion to ensure that different members of the community with differential knowledge of threats offer their insights. For example, elders may have knowledge of the historical extent of the forest, women and men may have very different perceptions of threats related to the different forest resources they use and manage, and so on. When used appropriately this is a highly participatory tool that effectively incorporates qualitative data and generates a product that multiple stakeholders can use. Threat mapping is often most effective when used in combination with some of the other more quantitatively oriented tools.

GIS-based tools offer more advanced threat mapping by reflecting quantitative data in

[103] Robinson, 2000; WCS, 2004.

[104] Biodiversity Support Programme, 1995.

sophisticated spatial maps. Direct threats, such as habitat fragmentation, can be represented in maps by showing changes in data over time. GIS-based threat assessment tools can range from simple maps that reflect data collected on the ground to complex decision-support systems incorporating threat data into programmes that model alternative scenarios and outcomes using criteria established by users. Visual products reflect alternative scenarios, and an appropriate and transparent criteria and value-setting process can help generate significant buy-in from stakeholders engaged in the process. These tools are heavily reliant on quantifiable data, and depending on the specific technology, their utility may suffer from limited or unreliable data. GIS-based threat assessment requires technical skills and equipment. These tools are particularly useful for generating baseline data sets and for monitoring change over time from restoration interventions.

4. Future Needs

A key challenge to forest restoration programmes is more effective integration of relevant threat analysis that is critical for making pragmatic and real decisions. Threat analysis has been seen as a discrete background research activity that, once completed, often gets put on a shelf, never to be revisited as part of strategic programme development and adaptive management. The gap between threat assessment, often seen as primarily scientific and academic investigations, and actual project implementation needs to be more effectively breached.

To improve the rigour and utility of threat assessments for forest restoration, approaches for undertaking integrated and multidisciplinary analyses also need to be refined. Biologists, social scientists, conservation practitioners, policy makers, economists, community leaders, and investors all bring a different lens to threat analysis. Through a combined view of the factors affecting restoration, more informed and pragmatic decisions can be made regarding trade-offs that inevitably must be made in the real world.

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11
Perverse Policy Incentives

Kirsten Schuyt

Key Points to Retain

Many government incentive programmes in reforestation and afforestation suffer from poor design, lack of enforcement, and lack of monitoring, and are aimed at short-term tree-planting activities.

As a result, government support for such schemes acts as a perverse incentive that can sometimes undermine efforts at introducing more balanced or equitable forms of restoration.

Instead, incentives need to be redirected toward a wider more integrated approach. This allows broader benefits to society, the involvement of local partners and stakeholders, and effective monitoring and evaluation.

1. Background and Explanation of the Issue

In some countries, government incentives for particular kinds of restoration have distorted approaches to the conservation, restoration, and management of forests. Government incentives to the forest industry for restoring forest cover have traditionally been aimed mainly at supporting plantation development. In light of the financial costs of these incentive schemes, and criticism from some environment and social welfare groups, questions have been raised about the economic, environmental, and social benefits of these schemes. Although many public incentives in forestry have provided some employment and income opportunities, questions remain about the overall costs of such schemes and about who will bear these costs in the longer term. For example, some studies have pointed out social and equity concerns when subsidies are captured by a few actors, such as large companies and landowners. In Chile, 80 percent of public incentive payments for the establishment of plantations have gone to three companies.[105] Other poorly designed incentive schemes have resulted in increased conversion of natural forests and land degradation. The key question is: Are public funds for afforestation and reforestation directed toward projects that provide net benefits to society?

A case study review by Perrin[106] showed that government incentive programmes in reforestation and afforestation activities tend to suffer from poor design, a lack of enforcement mechanisms, and little or no monitoring. Public incentives are often applied for short-term tree planting activities that inadequately address sustainability, biodiversity, and livelihood concerns. Little emphasis is paid to ensuring that public incentives contribute to restoring forest functions and resources, and they seldom benefit from adequate stakeholder participa-

[105] Bazett and Associates, 2000.
[106] Perrin, 2003.

tion. There is also a general lack of adequate monitoring and enforcement mechanisms, meaning that incentives are easily misused.

The Convention on Biological Diversity[107] identifies three common types of perverse policy incentives:

- Environmentally perverse government subsidies: Many different definitions exist in the literature as to what a subsidy is. In general, they include direct subsidies (such as grants and payments to consumers or producers); tax policies (tax credits, exemptions, allowances, and so on); capital cost subsidies (preferential loans or debt forgiveness); public provision of public goods and services below cost; and policies that create transfers through the market mechanism (such as price regulations and quantity controls). Such subsidies may have a negative impact on biological resources by directly encouraging behaviour that leads to biodiversity loss. Another example of perverse effects of subsidies is that they may drain scarce public finances that could have been used to conserve biodiversity.
- Persistence of environmental externalities: Some governmental policies may contribute to the persistence of negative externalities. For example, government policies may weaken traditional property rights systems, where such rights reside within customary law or cultural traditions. This absence of well-defined property rights at private or communal level may lead to pollution and overexploitation of natural resources, resulting in negative externalities or costs to third parties.
- Laws and customary practices governing resource use: An example of formal law generating perverse incentives is beneficial use laws requiring land users to make productive use of water and forest resources to secure land entitlement. On the other hand, the clearing of land may be rooted in customary law to indicate a claim to an area, leading to perverse incentives.

Perverse incentive schemes, however, can be redirected to promote restoration practices that will offer benefits to conservation and to a wide range of stakeholders. In this respect, forest landscape restoration offers important tools for good practices in restoration, and the key lies in promoting these tools to redirect existing perverse incentive schemes toward restoration that benefits conservation and society. Some examples are provided below.

2. Examples[108]

2.1. Public Incentives for Plantation Development, Indonesia

Deforestation is a major problem in Indonesia. The Indonesian government began promoting the development of industrial tree plantations in the 1980s to boost industrial development in wood-based industries and the oil palm sector. Several government incentives were put in place to stimulate timber plantation development, including interest-free loans, allocation of state-owned land, absence of land taxes, and so on. Large sums of money could also be obtained through the Reforestation Fund. Another incentive came from the International Monetary Fund–backed restructuring of the corporate and banking sector in the late 1990s, which was poorly implemented and led to subsidies and financing being provided to badly managed and corrupt forest companies.

In an attempt to redirect some of these public incentives, WWF, the global conservation organisation, has collaborated with the Centre for International Forestry Research (CIFOR) to restructure debt agreements related to the forest and oil palm assets of the Indonesian Bank Restructuring Agency. This reform is to include a series of checks and balances among the state, private sector, and civil society to mitigate structural pressures on the economy and forests, which should help prevent the use of funding for unsustainable and sometimes illegal plantation development as has happened in the past.

[107] CBD, 2002.

[108] Perrin, 2003.

2.2. CAP and SAPARD Forestry-Related Incentives, European Union

Two key programmes of the European Commission (EC) that provide incentives for afforestation and reforestation are the Community Regulation Directive 2080/92 (later introduced as part of the Common Agricultural Policy, CAP), which promotes afforestation of agricultural land, and the Special Action for Pre-Accession Measures for Agriculture and Rural Development (SAPARD), which focusses on rural development in European Union (EU) accession countries and includes funding for afforestation. Both of these schemes have been widely criticised as perverse incentives (also see the case study that follows this chapter).

Under the CAP, detailed analysis in 1997 suggested that the decrease in utilised agricultural land was marginal and that the role of afforestation under CAP had been overestimated. Also, the application of the directive varied between member states, with six countries accounting for more than 90 percent of total area planted. Lastly, the analysis found examples where funds had been misspent—for instance, in Spain, where farmers frequently planted, cleared, and replanted the same plots, all with subsidised funds from the EU.

Under SAPARD, it has been noted that the procedures have proven to be a big burden for many countries. In addition, concerns have been raised about some of the damaging impacts of SAPARD, such as the use of chemical protection, fence building, and construction of new roads. Also, no requirements are given under SAPARD for a minimum percentage of native tree species to be planted or incentives to enhance environmentally sound management practices. Environmental measures related to forests are only marginally included in national plans.

WWF is working both in the context of CAP and the EU enlargement process to ensure that EC policies promote sustainable rural development. For example, in 2001 WWF undertook a comprehensive review study of SAPARD-related forestry measures, and it also took part in the midterm review of the CAP. Some of the main issues that emerged relate to improving monitoring and follow-up with different beneficiaries of afforestation subsidies.

2.3. Grain-for-Green Programme, China

The goal of China's Grain-for-Green programme, launched in 2000, was to convert steep cultivated land to forest and pasture. It was initiated as a result of severe flooding in China that was blamed on excessive logging and cultivation along the Yangtze and Yellow Rivers. The programme is expected to turn more than 340,000 hectares of farmland and 430,000 hectares of bare mountain back to forests. These activities are to be carried out by the communities and subsidised by the government. In return for afforestation and reforestation activities, communities receive grain, cash, and seedlings.

The positive effects of the incentive programme so far are that the incentives have contributed to afforestation and reforestation activities as well as natural forest protection. However, the long-term sustainability of the programme remains uncertain along with its ability to prevent soil erosion. Much restoration has involved planting orchards on steep slopes, which do little or nothing to stop soil erosion. An important weakness of the programme has been a lack of monitoring and virtually no evaluation of the policy implementation.

The Chinese government has been open to reviewing its scheme following preliminary recommendations by WWF. The Centre for International Forestry Research has also undertaken a thorough assessment of the lessons learned from this scheme (see "Local Participation, Livelihood Needs, and Institutional Arrangements") as well as other reforestation/rehabilitation efforts in China and provided a number of concrete recommendations.

3. Outline of Tools

Options to remove or mitigate public perverse incentives in the forestry sector are described here. Perrin[109] recommends redirecting public incentives within the context of the forest landscape restoration approach. This means governments and donor agencies need to (1) allocate resources to the development of alternative forms of afforestation and reforestation activities that provide broader benefits to the environment and society, (2) involve local partners and stakeholders in incentive schemes (mechanisms for consultation and participation need to be put in place), and (3) spend resources on regulating the application of incentive programmes for afforestation and reforestation activities and monitoring the impacts of such activities (including developing sets of indicators and criteria to assist monitoring). This needs to be accompanied by the necessary policy measures, institutional arrangements, and monitoring and compliance mechanisms. In this respect, the CBD[110] recommends three ideal phases:

- Identify policies or practices that generate perverse incentives. This includes: analysing underlying causes of biodiversity loss, identifying the nature and scope of perverse incentives, identifying costs and benefits to society from removing the perverse incentives, doing a strategic environmental assessment, and so on.
- Design and implement appropriate reform policies. Reforms can include the total removal of policies or practices, or their replacement with other policies with the same objectives but without perverse incentives, or with the introduction of additional policies, and so on.
- Monitor, enforce, and evaluate these reform policies. This includes institutional and administrative capacity building, development of sound indicators, stakeholder involvement, and transparency.

[109] Perrin, 2003.
[110] CBD, 2002.

4. Future Needs

Despite the fact that numerous suggestions on how to address perverse policy incentives can be found (as described in the previous section), the reality is that many perverse policies still exist in the forestry sector. The key need is to start putting these new policies into practice, including the need for redirecting public incentives toward a forest landscape restoration approach at all levels in cases where policies have promoted habitat alteration or destruction and unsustainable use of natural resources. We also need to improve our understanding of the impacts caused by policies and practices on biodiversity. In this respect, the CBD[111] recommends undertaking further work on the use of valuation tools to assess the extent and scope of negative impacts of policies and practices on biodiversity.

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Case Study: The European Union's Afforestation Policies and Their Real Impact on Forest Restoration

Stephanie Mansourian and Pedro Regato

The European Commission has been promoting afforestation since 1992 under the Common Agriculture Policy (CAP) (Directive 2080/92) as a solution to reducing agricultural land and therefore, agricultural surpluses (which are currently supported financially through subsidies). More recently a sister scheme has been developed, the Special Action for Pre-accession Measures for Agriculture and Rural Development (SAPARD), which is applicable to European Union (EU) accession countries and covers the period 2000 to 2006, with a budget of over 333 million Euros.

Today, Directive 2080/92 is part of the Rural Development Regulation (RDR), which establishes a new framework for European Community support for sustainable rural development.

While the afforestation measures under the EU had spent four billion euros by 1999 and planted 900,000 hectares of trees, the results in terms of the original aims of the scheme, and also in terms of restoring forest cover and forest functionality remained disappointing.

Some of the key problems with the CAP afforestation directive include the following:

- Limited role in taking land out of agriculture: In most member states, only 1.3 to 1.4 percent of land has actually been set aside from agriculture following its application.
- Conflicting objectives: While the subsidy scheme was largely centred around taking land out of agriculture, many governments and companies used the scheme to establish timber plantations. In Ireland, for example, the subsidies were used to establish plantations with a high economic return (Sitka spruce, pines) in order to achieve the country's aim to double its forest area over the next 30 years.
- Unequal distribution of subsidies and "double dipping": Six countries accounted for more than 90 percent of the total area planted (Spain, the U.K., Portugal, Ireland, Italy, and France). In addition, individual examples show that funds were easily misspent. In Spain, the largest recipient of the EU afforestation funds, "double dipping" was discovered to be common, with farmers planting, clearing, and replanting the same plots all with subsidised funds from the EU.
- Unnecessary manipulation of natural processes: In many cases, subsidies were applied to reforest areas that were regenerating naturally. It is estimated that up to 62.5 percent of the area benefiting from the subsidy did not actually qualify as producing an oversupply of crops.
- Inappropriate methods and species: Over 65 percent of afforestation was carried out in areas believed at risk of fire under Council Regulation (EEC) No. 2158/92 on protection of the community's forests against fire. Planting was often done in an ad hoc fashion, without selecting optimal

areas to restore forest cover, nor were these properly integrated into land use plans.

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12
Land Ownership and Forest Restoration

Gonzalo Oviedo

Key Points to Retain

Forest ownership regimes matter for forest restoration because the end result of restoration, the trees, are the centrepieces of the ecosystem, and their consequent, associated goods and ecological services are of direct value to people. The ownership regime determines how such goods and services are accessed and distributed, and therefore, is the basis for restoration incentives.

It is necessary to undertake further research on experiences (successful and unsuccessful) of forest restoration under different types of ownership, to better understand how ownership rights' systems impact on the results.

1. Background and Explanation of the Issue

1.1. Forest Ownership: An Overview

The reports "Who Owns the World's Forests"[112] and "Who Conserves the World's Forests?"[113] indicate that globally, 77 percent of forestlands are owned by governments, 7 percent by indigenous and local communities, and 12 percent by individual and corporate landowners, and that in the last 15 years the forest area owned and administered by indigenous and local communities has doubled, reaching nearly 400 million hectares. This reflects important changes in forest ownership worldwide.

This chapter discusses the relationships between forest ownership and restoration, more specifically, the implications of the various types and conditions of forest ownership for successful restoration of forestlands. The basic assumption in this chapter is that forest ownership regimes matter for restoration because the end result of forest restoration, trees, are the centrepieces of the ecosystem, and their consequent, associated goods and ecological services are of direct value to people. In other words, the basic nature of the link between forest ownership and forest restoration is the fact that forest owners (whatever their specific regime and bundles of rights) are driven to restore (or not) by the expectation of goods and services that restored forests offer.

1.2. Definitions

The literature often does not distinguish "tenure" from "property" or "ownership" of forests, although in a more general sense "tenure" could be linked to custom-defined bundles of rights that are socially acknowledged, and "property" would be identified as a status in which customary tenure becomes more "institutional" through legal and political procedures and means.

Ownership or *property* itself is in essence a bundle of rights which are defined according to the nature of the subject and the legal frame-

[112] White and Martin, 2002.
[113] Molnar et al, 2004.

work in a given situation. Such rights can be listed[114] as the rights to (1) possess and exclusively physically control, (2) use, (3) manage, (4) draw income, (5) transmit or destroy capital, (6) have protection from expropriation, (7) dispose of interest on death, (8) potentially hold property forever, (9) reversionary/residual interests arising on expiration, (10) liability to seizure for debts, and (11) prohibitions on harmful use. There are many differences in the way in which these various rights are defined and apply to forests in different countries and social and historical contexts; some of these specific rights appear to be particularly important when dealing with sustainable forest management and forest restoration, as will be discussed later.

The literature distinguishes four main types of property applicable to lands and forests: private (individual or corporative), state, common or communal, and open access. These systems have been studied extensively, and their advantages and disadvantages with regard to natural resource use are well documented (for a useful typology and comparative analysis, see GTZ, 1998).

In country regimes of the 20th and 21st centuries, the rule for forest ownership is typically a combination of these four types of property, with significant changes in the composition of property according to historical moments and with great differences among countries. Generally, however, the predominant pattern is for the majority of forest areas to be in the hands of government, and only a small proportion being communal forests. In modern times, legally speaking there is little if any open access in forestlands, as any forestlands without private owners are automatically converted by law to state lands. In practice, however, state-owned forest has in many cases meant open access, as governments, particularly in developing countries, have had little capacity to control access to their forests. In developing countries, however, the establishment of large state-owned forest areas was in most cases the result of the expropriation of forestlands from their traditional users, who until colonial times were owners of those lands (or parts of them) under customary tenure. In this sense, and in cases where traditional forest-owning communities still exist and inhabit their traditional lands, there is an overlap of state property and communal, customary tenure.

Partly due to the recognition of customary tenure as legal communal (or individual) property, forest ownership is undergoing a major change in the world, with the main trend being the transfer or "devolution" of ownership rights to the local level, and the consequent expansion of community-owned forests.

1.3. Degree of Dependence on Forests

From the perspective of goods and services that forests (standing or future) offer, there are roughly two types of owners: forest-dependent people and non–forest-dependent people (and institutions). This distinction is important because of the expectations of the end result of forest restoration and their implications. Forest-dependent communities basically expect from restored forests an array of goods and services of direct economic value. They may value other associated benefits, such as ecological services at a landscape scale—climate change mitigation, regulation of the hydrological cycle, watershed protection, etc.—but they will normally not place higher values on associated ecological services than on those related to direct forest produce.[115] In the cases of non–forest-dependent owners, such as the absentee forest owner and the state and public agencies, the scale and hierarchy of values may vary for some areas, and their expectations, therefore, may not directly be linked to the economic importance of forest produce, but to ecosystem protection and services, biodiversity conservation, aesthetic aspects (which in turn can become economic values for example from tourism), etc.

[114] Ziff, 1993, cited by Clogg, 1997.

[115] Some exceptions exist to the hierarchy of values of forest restoration from the perspective of forest-dependent owners, but they are exceptions that do not contradict the primary expectations on forest produce or alternative livelihoods. For example, this is the case of restoration of degraded forest areas with sacred or particular spiritual value to local communities.

1.4. Ownership of Land but Also of Forest Goods and Services

Forest ownership differs significantly from other types of land and resource tenure—agricultural land, for example. The differences rely basically on the wide array of goods and services of the forest, and more specifically on the fact that forest ownership consists of a complex mixture of three types of ownership rights: rights to the land, rights to the forest resources, and rights to the trees. Further, ownership rights in forestlands overlap frequently with, and are different from, user rights. As Neef and Schwarzmeier[116] illustrate for Southeast Asia, in some cases groups or individuals holding the property of the land recognise rights of other individuals or groups to use the trees existing on that land, as long as there are no competing uses over the trees. There could even be multiple layers of rights on a single plot of land; for example, when a group or individual has property on the land, another group has rights on nontimber forest products, and another group holds rights on timber exploitation.

1.5. Opportunity Cost and Intergenerational Equity

Tree growth takes place over long or relatively long periods, when the forest ecosystem under restoration can offer only limited services; therefore, we are dealing with situations where there is a high, or relatively high, opportunity cost in the use of the land for forest-dependent people. In these conditions, only significant incentives and economic alternatives can cover the opportunity cost of forest restoration. The nature of benefits and incentives from forest restoration in terms of the time horizon (especially in cases of slow-maturing tree species) adds a time perspective to tenure security. For forest owners and users, it is not sufficient to know that their rights to forests and trees are secure now; it is more important to know that they will be secure and enforceable after one generation or more. In this sense, changing ownership and rights policies are even worse than the absence of them, since they cause a great lack of confidence in restoration as something socially beneficial.

1.6. Stability of Forest Ownership

In the case of China, Liu Dachang[116a] finds no conclusive evidence that user rights on trees are the best option (e.g., compared to state regulations), but does find evidence that changing rights policies were the basis of ups and downs in forest cover, and especially that lack of stability of forest ownership policies was the main reason for decline in forest cover and tree planting in certain periods; in fact, over approximately 25 years of China's modern history (from 1956 to the early 1980s), there was a succession of at least five major forest ownership policy paradigms, thus an average of a major policy change every 5 years. In practice, a few years after villagers planted trees, a major policy change would affect dramatically their rights to those trees and forests. The results were simply lack of confidence in the system and lack of incentives for tree planting.

Generally, the evidence is that where tenure security was greatest, tree planting was most successful. Tenure security means basically three levels: land tenure security, forest ownership security, and also user rights security.

1.7. Communal Systems

Several researchers have pointed to the fact that communal forest tenure, especially in conditions of market economies, requires a "critical group size" to be effective, where enforcement of rights and regulations can be optimally implemented, and where economies of scale and diversification make opportunity costs affordable, particularly when the community has to invest in forest restoration or reforestation. In other words, in any particular situation of communal forest ownership, it seems that there is a certain size of the group where forest management works best; if it is too small or too big, management is inefficient.

In many places, forest communities have tended to solve this issue by establishing a dual community/user group system, where forest

[116] Neef and Schwarzmeier, 2001.

[116a] Dachang, 2001.

ownership remains at the community level, but user rights (especially for trees) are allocated to smaller groups that act as forest management units. For example, in Honduras group-based management has proven better than community-based management, but the experience also shows that links between both are critical at decision-making levels on broader issues such as natural resources linked to forests: "What is required, therefore, is an institutional arrangement that retains forest management under group control, but which also provides a protocol for liaison between group and community and possibly some form of profit-sharing"[117] i.e., an arrangement where land and forest ownership remains in the community, where decision making for the entire area or landscape lies, while user rights for trees and other products are allocated to forestry groups who act on behalf of the community.

The same logic applies to the duality community-households in many communal ownership regimes.

An effective articulation of forest ownership and use rights between small units (even individuals) and larger units (community) seems therefore a critical element for successful forest management and restoration (although not the only element, as already indicated). It is also a fundamental tool to deal with the very important elements of equity and social stratification or differentiation. It has been documented that as much in agricultural lands as in forestlands, the egalitarianism that dominated ideological paradigms of agrarian reform and forest estate reform in the 20th century produced large fragmentation of lands and forests as a result of the distribution of family plots. The intention of the reformers, who were probably aware of the need to address problems of stratification within rural communities, was to overcome community differentiation by allocating equal plots to all families.[118]

[117] Markopoulos, 1999, p. 46.

[118] As an example, in China, under the Land Reform Campaign initiated in 1950, "all rural households in a given geographical area were given equal forest resources" (Liu Dachang, 2001, p. 241). Exceptions to this policy were Tibet and the ethnic minority areas in the South of Yunnan, where community forests were established.

In areas where this type of reform took place, fragmentation often made forest management extremely inefficient, and restoration virtually impossible, as a "critical size" is required in plots of forestland to make restoration or reforestation viable; tree planting in these conditions is often reduced to small numbers of trees around houses and within agricultural plots—normally fruit trees.

1.8. Equity Issues

Stratification of local communities in relation to forest ownership is one of the equity issues that need to be addressed in community-owned forests. Experience shows that often the most forest-dependent groups have the least user rights, especially women,[119] a situation that creates obstacles to developing solid, long-term, rights-based incentives for forest restoration. As in the case of the relationship group/community, finding the appropriate articulation of forest ownership and use rights between specific groups of users, including individual users, and larger units (forests groups and communities), in a stable, long-term policy framework, is critical to forest rehabilitation success.

2. Examples

2.1. China: Restoration Benefits and Incentives

Liu Dachang[120] has extensively researched the experience of China on forest policies, and concludes that generally user rights on trees are of greater importance than forest ownership per se for sustainable management and particularly for tree planting, reforestation, and restoration. For example, Liu Dachang shows that despite clear tenure policies on forestlands in China, in periods of stringent protective regulations on trees there was no incentive for reforestation; strict market regulations, aimed at protecting forests by discouraging commercialisation of

[119] Neef and Schwarzmeier, 2001.

[120] Dachang, 2001, 2003.

timber, ended up discouraging tree planting and therefore slowing down or totally stopping reforestation of degraded lands owned by villagers. The conclusion here is that, at least in the case of China, regulations to protect forests by restricting tree owners' rights to trees and timber in fact removed incentives for tree planting and therefore for reforestation and restoration. Successful forest restoration depends on incentives for tree owners to use the trees when they are mature, and for forest owners to use also other forest products and services; it thus depends on the clarity, extent, and enforceability of user and owner rights over trees and forest products, where timber use seems to play a major role.

But, if forest ownership rights are insufficient or even ineffective for successful restoration when not combined with user rights on trees and products, total lack of regulations on the use of timber and forest products can create perverse market incentives, especially when the conditions of clarity and enforceability of rights are not present in other adjacent forest areas. In such conditions, perverse market incentives discourage owners and users from tree planting, as the pressures from unregulated markets where competition exists from unsustainably managed forest areas (for example, areas subject to illegal timber extraction) would make it impossible for forest owners to meet the opportunity costs of tree planting and forest restoration.

2.2. Forest Rights in Ethnic Groups of Thailand and Vietnam

"The concept of individual rights to planted trees on agricultural fields applies to virtually all ethnic minority groups in the uplands of northern Thailand and Vietnam,"[121] but there are considerable differences in gender-specific rights to plant trees due to distinct inheritance laws.

"In strictly patrilineal societies like the Hmong, women are not allowed to inherit land. Thus, tree planting by women is usually limited to the area around the houses. . . . In contrast to the Hmong, the Black Thai and Tay societies have strong matrilineal elements. Although land inheritance of women is not common, there are a few exceptions giving women fully individual use rights, including the rights to plant trees. . . . Marketing of forest products such as bamboo shoots, medicinal plants and fuelwood is mainly done by women. Despite the strong involvement of women in collection and marketing of products from the forests, they do not play a role in setting management rules."[121a]

2.3. Strengthening User Rights for Forest Restoration in Northeast Highlands of Ethiopia[122]

The Meket district in the North Wollo administrative zone of Ethiopia ranges in altitude from 2000 to 3400 m above sea level and has a mix of agroclimatic zones. Its inhabitants are almost wholly dependent on agriculture. As rising numbers of people have put more pressure on the land, fallow periods have shortened, and continuous ploughing has become commonplace. Local people say that within a generation, there has been dramatic deforestation, and the grazing has declined in both quantity and quality. Expanding cultivation and increasing demand for wood have left even the steepest slopes unprotected. Only about 8 percent of the total area remains under forest. Much of the rainfall is lost through runoff, causing severe soil erosion and floods. Indigenous trees are not commonly allowed to regenerate (except on some church lands), and efforts to plant trees have had little impact.

The Ethiopian people have had negative experiences of land reallocation over the last 20 years, and are hence unwilling to invest effort in reforestation or regeneration activities. Different types of forest ownership (individual, church, service cooperative, and community) can be found in the district, but none has reversed the natural resource depletion.

Weak land-tenure and user rights were clearly hindering effective community-led environmental conservation in Meket.

[121] Neef and Schwarzmeier, 2001, p. 22.

[121a] Neef and Schwarzmeier, 2001.

[122] International Institute of Rural Reconstruction, 2000.

In mid-1996, SOS Sahel, an international nongovernmental organisation (NGO), began working with local authorities and agriculture ministry staff to seek a way to work with communities and solve these problems. Central to these was the establishment of official user rights for villagers.

In the community reforestation project, communities were allowed to define their own objectives for their sites, but long-term plans (5 to 10 years, or more if indigenous trees were established) were required. Within communities, reforestation groups were established, and each group decided how to share the benefits among its members, and this had to be included in the management plan. Similarly, each village developed its own strategy for guarding the site.

The proposed plan was then presented for approval at the kebele (subdistrict) level by relevant bodies: community representatives, subdistrict officials, and church leaders. It was then submitted to district officials and the agriculture office. If the plan was approved, official user rights were given to the group for their site.

As a result of this approach, farmers' participation in reforestation efforts increased. At first, 14 villages received official user rights; 20 more communities have since become involved, directly benefiting more than 2000 households.

Natural regeneration of indigenous grass, shrub, and tree species has been dramatic. There are very clear differences when compared with unprotected sites.

Sufficient short-term benefits have been realised—such as improved forage and increased production of thatching grass—to motivate communities to strengthen and expand their enclosure sites.

More secure user rights have created confidence among the communities. They have expressed strong interest to plant indigenous species (e.g., *Hagenia abyssinica, Juniperus procera, Olea africana*) instead of eucalyptus.

Communities have started to expand their sites, and new communities want to establish their own enclosures. Some are seeking compensation from the subdistrict administration for individual farmers who are cultivating land within the future enclosures. Some villages have even begun a similar process without outside intervention or support.

Farmers seem to have accepted the introduction of cut-and-carry fodder systems. This may prove to be one of the most significant impacts for the Ethiopian highlands.

2.4. Limited Success in the Protection Forest Walomerah, Indonesia[123]

The province of East Nusa Tenggara consists of the main island of Flores, Sumba, the Western part of Timor and a number of smaller islands. In 1992 the population of the province totalled 3.3 million. With an average rainfall ranging from 2196 mm in Manggarai district to 805 mm in Alor district and not so fertile soils, the conditions for agriculture are not very favourable.

About 36 percent of the land area of the island of Flores has by ministerial decree been classified as forest land and one third of this forest land as Protection Forests. The largest part of this has in reality little or no tree cover and has for generations been tilled by the population living there.

The protection forest of the mountain Walomerah in Ngada district is one such area. As part of the Presidential Instruction Programme (INPRES) for the development of Indonesia, this particular protection forest was to be reforested. The project, which began in 1995, was to start with the reforestation of 500 hectares, including part of the village Wangka, which covers 9000 hectares. Almost all of the 2400 inhabitants secure their livelihoods from subsistence farming, as their ancestors have done for generations. They are totally dependent on the land. Their traditional rights to land had been recognised by the government, but all 9000 hectares of this village lie within the protection forest. According to the legislation applying to such areas, the villagers were not allowed to occupy this area on a permanent basis.

[123] Vochten and Mulyana, 1995.

The Forest Service decided it was necessary to consult with these villagers with the purpose of better understanding their living situation and see to what extent the reforestation project could be modified to accommodate their needs and aspirations. Several problems directly or indirectly connected with the proposed reforestation were identified by the villagers who took part in such consultations. The problem concerning the status of their land tenure rights surfaced as a key conflict. Even though they had been paying their land ownership taxes regularly, rights to use forest products could not be granted to them.

This key issue, land tenure rights, was not solved in this reforestation project. Some useful compromises were reached, and an attempt was made to balance the undisputed need for reforestation with the primary need of farmers—land. But clearly it was not possible to move ahead with enough confidence in the project's success without addressing further the issue of land and forest produce rights.

3. Outline of Tools

Tools useful to addressing ownership issues in forest restoration are basically the same that have proven useful in the case of examining land and resource tenure in different conditions.

1. Land and resource mapping: This can be done at any level, to learn about the environmental, economic, and social resources in the community. A variation of mapping is the technique of transects, which focusses on specific areas of a community's land, for learning about the community's natural resource base, land forms, and land use, location and size of farms or homesteads, and location and availability of infrastructure and services, and economic activities.

2. The International Tropical Timber Organisation (ITTO) restoration guidelines are a useful tool addressing ownership issues. To ensure secure land tenure, these guidelines recommend (recommended actions 13 to 16): "13) Clarify and legitimise equitable tenure, access, use and other customary rights in degraded and secondary forests among national and local stakeholders. 14) Strengthen the rights of forest dwellers and indigenous people. 15) Establish a transparent mechanism for conflict resolution where property and access rights are not clear. 16) Provide incentives for stabilizing colonists/farmers in agricultural frontier zones."

3. Participatory rural appraisal (PRA) or participatory rapid rural appraisal have been described many times in the literature.[124] A methodological illustration of a PRA exercise for forest restoration in Indonesia[125] is as follows:

> The PRA facilitator team included 14 people: from the government . . . , from local NGOs . . . , and the authors. . . . The main actors were the residents of two of the four hamlets of the village Wangka, which adjoined the proposed reforestation site. They collected the information, analysed the problems, considered the options, and drew up the final reforestation plan. The facilitators supported this by introducing certain techniques to structure the information. They also listened and learned. The entire PRA lasted only three days in the field, from October 12–14, 1993. It was preceded by a one day gathering of the facilitators to exchange information about the PRA techniques to be used and to inform themselves about the village of Wangka. At the start of the PRA, the facilitators introduced themselves and the purpose of their visit and then split into two groups each to cover one of the hamlets. On the first day a map of the village including the proposed reforestation site was made. Then a seasonal calendar, presenting the main events and activities of the community (agricultural, religious, festivals, etc.) was made. On the second day a transect of the respective hamlets and the proposed reforestation site was made. Later in the day a matrix ranking was done to learn about the preferred tree species. On the final day the results of the PRA exercise in both hamlets were combined and presented by the villagers who had been involved in the PRA at a village meeting. This was also attended by representatives from the other two hamlets, the village head (kepala desa), and the head of the Forestry Service of Ngada District. During this meeting, spiced with animated discussions, problems were reviewed

[124] Notably, Chambers, 1994; Chambers and Guijt, 1995.
[125] Vochten and Mulyana, 1995.

and compromises made. Finally a work programme for implementing the reforestation project was produced. To ensure its future implementation the facilitators met with representatives of the concerned government agencies and presented the proposal to them the next day.

4. FAO's Socio-economic and Gender Analysis (SEAGA): This is an approach to development based on an analysis of socioeconomic patterns and participatory identification of women's and men's priorities. The objective of the SEAGA approach is to close the gaps between what people need and what development delivers. It uses three toolkits: the Development Context Toolkit, for learning about the economic, environmental, social, and institutional patterns that pose supports or constraints for development; the Livelihood Analysis Toolkit, for learning about the flow of activities and resources through which different people make their living; and the Stakeholders' Priorities for Development Toolkit, for planning development activities based on women's and men's priorities.

5. Dachang approaches the analysis of drivers for forest restoration in South China through a logical procedure consisting of three stages: diagnosis, design, and delivery (Tri-D). This procedure is the result of an adaptation of farming system approaches and rapid rural appraisal (RRA) or PRA to the identification of problems and to the design and testing of forestry and agroforestry options. This procedure has been used commonly in community-based agroforestry research.

6. User rights/stakeholder analysis: A general long-term objective is to gain knowledge about the community, and to appreciate "how to approach and structure a collaboration process."[126] For WWF, stakeholder analysis "is the process by which the various stakeholders who might have an interest in a conservation initiative are identified. A stakeholder analysis generates information about stakeholders and their interests, the relationships between them, their motivations, and their ability to influence outcomes. There are numerous approaches to stakeholder analysis, ranging from the formal to informal, comprehensive to superficial." A frequent problem of these approaches, however, is a narrow understanding of stakes and differentiation within communities, associated with the absence of consideration of tenure rights. A second conceptual and methodological problem is that often conservation organisations define primary stakeholders as "those who, because of power, authority, responsibilities, or claims over the resources, are central to any conservation initiative," while in reality primary stakeholders are those with closer dependence and rights on the resources involved.

7. The German agency GTZ proposes four principles to assist decision makers in the process of drafting and enforcing property related legislation. The principles also serve as yardsticks for evaluating existing land tenure systems and reforms, and thus they can be used to assess the forest ownership situation in any given country, and monitoring progress in establishing clear tenure systems. The proposed principles are (1) certainty in law, (2) the rule of law and human rights, (3) political participation of the population in land issues, and (4) definition of property in market economies. Ideally, the development of forest restoration interventions should be preceded and accompanied by a process by which these principles guide an appraisal of the situation of forest ownership, and help identify the critical interventions to follow to ensure success of the initiatives in the long term.

8. The International Institute of Rural Reconstruction[127] offers advice as shown in Box 12.1 on addressing land tenure issues. This is largely applicable to situations where forest restoration is planned, and where forest ownership is an issue requiring specific actions.

4. Future Needs

The following areas require further development:

- Understanding better the complex issues of rights and how they interact with various factors, such as incentives and policy environ-

[126] WWF-US, 2000a,b.

[127] International Institute of Rural Reconstruction, 2000.

Box 12.1. Do's and Don'ts from International Institute of Rural Reconstruction (2000)

Do's

Begin with a clear understanding of the local situation and policy context.

Use a two-pronged approach for advocacy and lobbying work—at the top with policy makers, and on the ground to demonstrate impact.

Start with a clear shared vision with partners at all levels.

Have a clear understanding of policies and strategies.

Prepare clear guidelines in the local language and share with all stakeholders.

Actively share experiences and ideas.

Be patient: be prepared to invest a lot of effort and time.

Strive to build the technical and managerial capacity of communities.

Full coordination with local government officials and line agencies is essential; they can play a key role in monitoring the entire process.

Work toward establishing official legislation for user rights to greatly strengthen the process.

Help communities understand that a short-term reduction in fuelwood availability will result from enclosure, and assist them to find ways to deal with this problem.

Don'ts

Don't start with sensitive issues (e.g., discussing the problems of the land-tenure situation).

Don't allow conflicts to become too large. Try to resolve them as soon as possible.

Don't impose plans.

Don't monopolize the intervention. Partners should be key players in the process.

ments, is a task that needs to be undertaken on the basis of specific cases of forest restoration. It is therefore recommended that such initiatives include in their plans the ongoing accompaniment of the process by researchers equipped to understand the links between rights and incentives.

- Use experience to synthesise guidance in the form of option menus for dealing with tenure issues in different situations. For the moment, most of the experiences of forest restoration offer lessons of mostly local or national value on ownership matters, difficult to generalise and to apply to other situations. An analytical effort of learning more from those lessons and then systematising them for guidance would be valuable, always with the understanding that lesson-based guidance is indicative only, and any mechanistic application of experiences from one place to another needs to be avoided.
- Research further on experiences (successful and unsuccessful) of forest restoration under different types of ownership, to better understand how rights' systems (including from creation or granting of rights to law enforcement and judicial processes) impact on the results—in the short, medium, and long terms. In undertaking such research, it is fundamental to use a conceptual and methodological framework that is based on the understanding of the complexities of the bundle of forest ownership rights, avoiding for example an exclusive focus on land tenure.

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13
Challenges for Forest Landscape Restoration Based on WWF's Experience to Date

Stephanie Mansourian and Nigel Dudley

Key Points to Retain

Some of the most important challenges identified by WWF's forest landscape restoration programme in its first four years, include the following:

The need to better value forest goods and services

The need to increase capacity to deal with landscape restoration issues

The need to better monitor the return of forest functions at a landscape scale

1. Introduction

Since the start of its Forest Landscape Restoration programme in 2000, WWF, the global conservation organisation, has faced a number of challenges related to (1) the planning of restoration in large scales, (2) the integration of social and ecological dimensions, and (3) the implementation of restoration programmes on a large scale. A more detailed analysis of specific lessons learned from forest landscape restoration projects can be found in this book in the part entitled" Lessons Learned and the Way Forward." This chapter focusses instead on specific challenges anticipated for future programmes to restore forest functions in landscapes, based on experience in the first 4 years of WWF's restoration programme. While this draws on experience within one organisation, we hope that the brief summary of some of the tasks we have identified will also be useful to governments, nongovernment organisations, (NGOs) and others interested in developing restoration projects, large or small.

We started WWF's restoration initiative with some concepts (e.g., the need to integrate socioeconomics, the concept of trading off land uses within landscapes, the idea of working at a landscape scale), and also some principles (e.g., balancing ecological and social needs, adopting where possible a participatory approach). For the last 4 years, we have been testing out these theories in practice in field programmes around the world. One early result was recognition that there was a lack of succinct information for practitioners, which was the driving force behind this book. In light of WWF's experience to date, a number of future challenges and opportunities have been identified[128]:

1.1. Setting Realistic Goals for Restoration Within a Landscape

A failure of past restoration efforts can be traced back to having started with unrealistic goals or alternatively with very narrow goals that fail to take into account local and surrounding socioeconomic realities. For this reason it is important to set goals that are at once realistic but also consider the many dif-

[128] Mansourian, 2004.

ferent outputs required from most landscapes. In a landscape context, restoration goals for conservation organisations will often be closely linked to other activities relating to protected areas and sustainable forest management. Thus, restoration may seek to complement a protected area or relieve pressure on it. Equally, restoration can happen within and around the estate of a managed forest. Forest restoration goals within a landscape generally have to address both social and ecological needs; they may, for instance, relate to restoration of species' habitat in one location but also to the establishment of fuelwood plantations elsewhere. In all cases, the key will be to attempt to balance those goals to provide optimal benefits (also see "Goals and Targets of Forest Landscape Restoration," "Negotiations and Conflict Management," and "Addressing Trade-Offs in Forest Landscape Restoration").

1.2. Ensuring that Restoration Is Not Used as an Excuse for Uncontrolled Exploitation

One reason many conservationists still balk at restoration is that it can be seen to provide a justification for failing to address the problems of degradation. Given the cost, duration, and difficulty of restoration, we do not believe that this is a viable argument. However, the fact that conservation organisations encourage restoration should not be interpreted as licence for degradation, because in many circumstances restoration activities will not be able to recover all of the values that have been lost. There is a fine line between actively offering restoration as a solution to dwindling natural resources without undermining efforts at protection or good management of these resources.

1.3. Active or Passive Restoration?

In some cases it is clear that restoration is already urgently necessary. At this point the first question for a community, conservation organisation, or government becomes one of choice between passive and active restoration. Passive restoration, which means creating suitable conditions for restoration to happen through natural processes (e.g., by fencing an area against grazing or preventing artificial fire) is usually considered to be the most desirable solution, being simpler, cheaper, and more akin with natural processes. However, there comes a point (a status of degradation or particular set of ecological and social conditions) when active restoration is necessary, either because recovery needs to be speeded up to protect threatened biodiversity or because ecological conditions have changed so profoundly that natural processes need some assistance. The challenge for conservation planners is sometimes whether to wait for passive restoration, and risk further degradation and in the future a more expensive restoration process, or to jump straight into active restoration. Development of a more sophisticated set of criteria or tools for helping make these kinds of decisions will be one of the major needs in the future.

1.4. Promoting the Concept of Multifunctional Landscapes

If conservation organisations are to address the big emerging issues related to forestry and biodiversity, we will need to engage much more closely with social actors, an example is the emerging WWF-CARE partnership. An emphasis on "multifunctional landscapes," that is, landscapes that provide a mixture of environmental, social, and economic goods and services through a mosaic of sites managed with differing but harmonised objectives, can help to provide balanced approaches in landscapes that contain both environmental and social problems. One implication of this is that forest restoration in most cases will not be a viable activity unless it goes hand in hand with forest management and usually also with forest protection.

1.5. Sustainability of Restoration—Valuing Forest Goods, Services, and Processes to be Restored

Active restoration is an expensive process, and in most cases conservationists (both state government and NGOs) still opt to direct available conservation budgets toward protection instead. However, in many cases these decisions are not being taken in full knowledge of the long-term costs and benefits. For instance, it is often easier to build political support for setting aside a mountainous area of forest to protection because it appears to entail limited cost, or at least delayed costs, whereas the apparent cost of restoring a more accessible or economically valuable habitat such as a lowland forest appears immediately. But if the long-term value of a restored forest were properly estimated, then on balance the net costs might not appear to be as high. In some cases, it may make more sense to focus efforts on protection, in others more on restoration or a mixture of both. One future challenge is to increase skills and tools for valuation of the costs and benefits of various approaches so that more balanced judgements can be made.

1.6. Long Term Monitoring and Evaluating Impact of Restoration within Large Scales

Monitoring and evaluation are essential in any conservation programme, to help facilitate adaptive management, and have been identified as one of the most critical elements in success. They become particularly crucial in a large-scale restoration effort, which will span several decades and will involve many different actors. Mistakes need to be redressed and improvements need to be made. Proper monitoring tools that are adapted to a large scale need to be developed and then applied rigorously.

1.7. When Can We Claim Success? When Is a Landscape Restored?

There is no clear end point for restoration. A natural forest is itself not a fixed or static ecosystem but is generally in constant evolution and flux. In any case, many restoration projects will not be aiming to re-create an "original" forest. Agreeing and then finding ways of measuring an end point is therefore a challenge particularly for organisations such as WWF, which work in time-limited programmes and to targets that are often agreed to between NGOs and donors. In practice, targets need to be set at the level of a specific landscape. For instance, is the ultimate aim of a forest landscape restoration programme to return a certain endangered animal species to a viable population? Or is it to improve water quality? Or is it to reverse the decline in forest quality? Many restoration projects have multiple aims, such as restoring habitat for species but also increasing nontimber forest products for local communities. By setting goals, conservation organisations should be able to establish meaningful programmes, whilst recognising that forest landscape restoration is never a short-term project with a clear beginning and end. Efforts should be longer term, and specific measures of success will necessarily be steps along a trajectory toward a healthier and more sustainable forest landscape.

1.8. Resources

Forest restoration at the scale of large landscapes can be enormously costly. In addition, the longer we wait before undertaking restoration, the more degraded the landscape is likely to have become (for instance, seeds of original species may no longer be present, soil conditions will have changed) and therefore the higher the costs of restoration are likely to be. Many restoration efforts have failed through lack of resources. Ideally, systems that integrate the cost of restoration within landscape-level activities via taxes (for instance on ecotourists) or via payment for environmental services (for instance, for the provision of clean water, also see "Payment for Environmental Services and Restoration") should provide long-term and sustainable financing for restoration activities. However, this assumes both that costs and benefits can be measured accurately, which is still often a challenge, and that there is sufficient political support for restoration that such payments can be levied. Establishing means for long-term funding that go beyond donor project cycles remains a key challenge for the future.

1.9. Capacity

A restoration programme carried out over large areas is likely to require many different skills, for instance negotiating skills, lobbying skills, monitoring skills, small enterprise development skills, plantation skills, nursery development skills, etc. It is important to ensure that local capacity to support the long-term restoration effort exists. In many cases this requires training as well as the partnering of different institutions to share their respective knowledge and expertise.

2. Examples

These examples demonstrate some of the practical challenges that have been encountered. They may not all be as fundamental as those listed above, but are interesting to highlight as they demonstrate the full range of challenges that may emerge from real experiences.

2.1. Vietnam: The Challenge of Dealing with Pressures on Remaining Forests

The government of Vietnam is well aware of the importance of its forests, for instance to ensure water quality, and has taken significant forest areas out of production. But pressures remain because local people face serious land shortages, and restoration efforts have until now mainly been aimed at intensive plantations that supply only a small proportion of the potential goods and services. Restoration efforts in Vietnam therefore need to embrace demonstration projects both to show what is possible and to work with government authorities to modify current restoration policies (see case study "Monitoring Forest Landscape Restoration in Vietnam").

2.2. Madagascar: The Challenge of Choosing a Priority Landscape for Restoration

In a country like Madagascar that has lost over 90 percent of its forest, it would seem straightforward to decide where to restore. Nonetheless, given scarce resources and given a difficult socioeconomic context (Madagascar is one of the poorest countries on the planet, and poor people survive largely from slash and burn agriculture), it is necessary to select priority area(s) to begin a large-scale restoration programme. In 2003 WWF brought together a number of stakeholders from government, civil society, and the private sector to define together what might be criteria for choosing a priority landscape in which to restore forest functions.

The group identified the following categories of criteria:

1. Sociocultural
2. Economic
3. Ecological/biophysical
4. Political

Within these categories, some of the 24 criteria were, for example:

- Type of land tenure
- Values attributed to forests by local people
- Proximity of fragments to a large forest plot
- Level of diversification of revenue sources
- Presence of management entity for the landscape
- Numbers of species used by local communities that have been lost
- Level of involvement of communities in local environmental actions

Members of the national working group on forest landscape restoration then visited a short-listed selection of landscapes and rated each against the 24 criteria. The outcome was a prioritised list of landscapes that need to be restored based on criteria that were developed locally and that were very specific to local conditions.[129]

2.3. New Caledonia: The Challenge of Dealing with Multiple Partners

It took 2 years to develop an agreed to partnership, strategy, and plan, and to engage eight other partners in the dry forest restoration

[129] Allnutt et al, 2004.

programme for New Caledonia. While this may seem a long time to invest in building a partnership, the fruits of such an effort are now being felt as the programme is taking off. The programme carries much more weight in the eyes of all stakeholders because of the partnership.

2.4. Malaysia: The Challenge of Identifying Priority Species for Restoration

While restoration along the Kinabatangan river was identified as a priority in order to reconnect patches of forest for biodiversity, the selection of appropriate species was not clearly done. For this reason a demonstration site has been set up where different species and techniques (from simply fencing to weeding or active planting) are being tested and monitored in order to identify the approach that is best suited to local conditions and which can then be propagated along the corridor.

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Section VI
A Suite of Planning Tools

14
Goals and Targets of Forest Landscape Restoration

Jeffrey Sayer

The most fundamental (question) relates to the definition of the goals and targets for restoration projects. It would seem that definition would be simple, but it is often complex and involves difficult decisions and compromises. Ideally, restoration reproduces the entire system in question, complete in all its aspects—genetics, populations, ecosystems, and landscapes. This means not merely replicating the system's composition, structure and functions, but also its dynamics—even allowing for evolutionary as well as ecological change (Meffe and Carroll, 1994).

Key Points to Retain

Outside experts cannot alone set goals and targets because they are never self-evident.

Careful multi-stakeholder processes are needed to set goals and targets that will be broadly accepted.

Goals and targets will change with time and need to be adapted.

Pristine "pre-intervention" nature is only one of many possible goals.

1. Background and Explanation of the Issue

A broadly shared understanding and acceptance by all stakeholders is fundamental to the success of any restoration project. There are countless examples of attempts at restoration failing because one person's "restoration" is often another person's degradation. Here are some examples:

- Attempts by the Indonesian Ministry of Forestry to "restore" Imperata grasslands by planting trees failed because local people had no use for the trees (they belonged to the foresters) but they made extensive uses of the grasslands. The grasslands provided fodder for their cattle and grass for roofing.
- Attempts to plant spruce forests to restore the degraded moorlands of northern England and Scotland were opposed by amenity and conservation groups because the moorland scenery had come to be accepted as "natural" and "beautiful" and it was the habitat of rare birds.
- Government attempts to restore tree cover on the uplands of Vietnam were opposed by local people because the types of trees planted by the government were not the ones that local people needed or could use.
- Government-sponsored tree planting schemes in China have denied local people access to medicinal plants and have damaged the habitats of rare plants and animals in the dry mountainous areas of South Western and Western China.
- Attempts to restore pristine nature in degraded areas in the United States are opposed by some conservationists who consider that such artificially restored areas can never have the value of a pristine landscape.

Pretending that restoration is possible is seen as a ploy by commercial interests to justify activities that degrade nature.

The basic problem is that what is perceived as "degraded" by one interest group may be perceived as desirable by another group. Foresters consider land degraded if it does not support a crop of commercially valuable trees. Ecologists consider a forest degraded if it does not have multiple layers of vegetation and a reasonable number of dead or decaying trees as habitat for birds and invertebrate. Amenity groups do not like dense forests; they want mosaics of woodland and open land with extensive views. The list is endless. The basic lesson is that there can never be a single vision of an "end point" for restoration that will automatically meet with the approval of all interested parties.

2. Steps to Success

The first task in any broad-scale restoration initiative, therefore, is to find out what everyone would ideally like to see as an outcome and then to negotiate compromises between what will inevitably be a collection of different viewpoints and attempt to come up with a scenario that is acceptable to all.

It is unwise to assume that once an end point has been negotiated that the "visioning thing" is done. As landscapes change so the perceptions and needs of interest groups will evolve. Restoration is often a moving target. Markets, recreational needs, conservation priorities, etc. all change with time, and what people want today will not necessarily be what they will want tomorrow.

Dunwiddie[130] has argued that objectives for restoration projects should be defined as "motion pictures" rather than "snapshots." The problem is that objects such as species are much easier to specify and monitor in projects than are processes such as ecosystem function and community dynamics.

The following concepts and approaches can be used as tools to ensure that forest landscape restoration projects are moving in the right direction:

2.1. Answer the Questions: Restoring What, for Whom and Why

These are the most important questions yet they are frequently not properly addressed in restoration projects.

These questions should be answered by real stakeholders—local people, conservation organisations, etc.—those who will do the work or incur the costs and benefits.

Avoid programmes that are "expert driven" and ensure that development assistance agencies stay honest, that they are explicit about their real objectives and recognise that they also are interested parties.

2.2. Work with Scenarios, Visions, and Stakeholder Processes

There is an abundant literature on methods for involving stakeholders in the development of scenarios and visions. Care has to be taken to ensure that the interests of less powerful groups are addressed. Achieving genuine public participation is not just common sense—it requires professional skills. Neutral professional facilitation is almost always necessary. The Centre for International Forestry Research (CIFOR) and the International Institute for Environment and Development (IIED) Web sites provide access to the literature on these approaches.

Simple modelling tools exist for exploring options and making assumptions explicit. STELLA, VENSIM, and SIMILE are widely used. These models are the best tools for developing scenarios, understanding the drivers of change in a system, making stakeholder assumptions and understanding explicit, and then tracking progress toward goals that are identified as desirable.

The concept of *getting into the system*[131] is fundamental. This means engaging for the long-term, becoming a stakeholder, and making one's interest explicit. In the case of WWF, as

[130] Dunwiddie, 1992.

[131] Sayer and Campbell, 2004.

with other conservation organisations, this interest is principally biodiversity, and we have to make commitments for what we are prepared to contribute in cash or other contributions to support the achievement of our biodiversity goals.

2.3. Understand Development Trajectories

What would happen if we did not intervene? What is the underlying development trajectory? What are the principal *drivers of change*? It is vital to get the correct answers to these questions. Modelling can help. Normally only a small number of drivers of change are significant at any one time. We have to know which ones they are and how they can be influenced.[132]

We must also understand the underlying processes of ecological succession.[133] The factors that influence restoration at a single location are not necessarily confined to that place. A variety of extrasectoral influences such as economic and trade policies and levels of public understanding of issues will have a continuing and variable influence on restoration processes.

2.4. Use Monitoring and Evaluation as a Management Tool

Monitoring and evaluation have to be linked to the desired outcomes of interventions. Negotiating these outcomes is the first and most important activity in any programme. Indicators of the desired outcomes have to be agreed to or negotiated at the beginning, and they then become the tools for adaptive management.[134] The book by Sayer and Campbell has a chapter on this issue that gives further references to the monitoring and evaluation literature.[134a]

2.5. Find and Protect Reference Landscapes

Whether or not the objective of forest landscape restoration is to restore the "original" vegetation cover, it will always be useful to have reference areas that are as near as possible to the natural conditions of the area (see "Identifying and Using Reference Landscapes for Restoration"). These are useful as benchmarks, for understanding ecological processes, for education, and as sources of plants and animals to be used in assisted restoration.

Much has been written about attempts to restore a pristine, climax, "natural" land cover. There are lots of problems with this approach, not least of which is the difficulty of knowing what the preintervention situation was. It is also important to avoid falling into the trap of assuming that natural systems reach a climax condition and are then constant—this is rarely the case. Even in the remotest and least disturbed parts of the Congo Basin or the Amazon the species' composition of the forests today is not the same as it was 100, 500, or 5000 years ago. Natural landscapes are highly dynamic, and decisions to restore to "natural" conditions will always be arbitrary and open to multiple interpretations. Reference landscapes, or plots, with minimal intervention remain valuable in helping us to understand landscape processes and can be useful components of any large-scale restoration programme. They can be valuable as examples to look at during negotiation processes.

Normally restoring "natural conditions" is just one of a range of possible objectives, and in most situations what one restores will be defined by more precise production and environmental objectives.

2.6. Be Realistic About Designer Landscapes

Once a comprehensive stakeholder participation process is engaged, it will gradually become possible to begin to talk about desirable outcomes. Eventually a vision of a "designer landscape" may begin to emerge. Different approaches and tools are useful to

[132] See the Web site of the Resilience Alliance and publication by Berkes et al, 2003.
[133] Walker and del Moral, 2003.
[134] CIFOR's work on Adaptive Collaborative Management provides guidance.
[134a] Sayer and Campbell, 2004.

explore what the landscape should look like in order to respond to the needs and wishes of different interest groups.

3. Outline of Tools

Stakeholders may decide that a certain landscape configuration and condition is ideal for their objectives. But usually different stakeholders have different ideals. To fine-tune a landscape vision, some specific approaches can be used depending on the restoration goal:

Biodiversity: Modelling tools developed by the United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC) are useful.[135] Some assumptions about corridors and connectivity have to be treated with caution.[136] One should not always assume that protected areas should be as big as possible. There are often significant opportunity costs that protected areas create for local people. Protected areas should be of an optimal size, not necessarily as big as possible.[136] The importance of seral stages in vegetation development is often underestimated. Many wildlife species require early successional vegetation for their survival.

Poverty mapping and assessment: The World Agroforestry Centre has a lot to offer on this topic (see "Agroforestry as a Tool for Forest Landscape Restoration").

Land care: The Landcare programme in Australia and now expanding elsewhere is an interesting model for participatory multi-stakeholder restoration programmes.

Water: Lots of common assumptions about the value of land cover for water quality and quantity are not borne out by empirical evidence. Forest cover may consume more water than it conserves; it all depends on the type of trees, the frequency and intensity of rainfall, and the nature of the underlying substrate. Expert advice should be sought on the hydrological implications of restoration programmes (also see "Restoring Water Quality and Quantity").

Amenity: The Netherlands, the United Kingdom, and the United States have restoration programmes with a heavy emphasis on amenity. This is the realm of landscape architecture.[138]

Avalanche control: This is an important issue in temperate and boreal countries and there is an abundant literature.

Timber: Timber is the real objective of much so-called restoration. Caution is needed because narrow timber production objectives are rarely consistent with the broader objectives of local people and the environment.

Tree crops: Tree crops include oil palm, coffee, cacao, rubber etc. More can be found on this topic in the chapter on agroforestry, cited above, but also in publications on extractive reserves and jungle rubber.

4. Future Needs

4.1. Improved Economic Analysis

Restoring landscapes is expensive, but can and should yield economic benefits. The valuation of environmental goods and services is still an imprecise science. The valuation of the subsistence products used by poor subsistence farmers is also a challenge. But all large-scale restoration initiatives have to be rooted in economic realism. The cost-benefit ratios are essential in determining what is possible and desirable. There are countless examples of forest restoration programmes that have cost a lot of money and yielded few real benefits.

It is especially important to remember that investments in restoration carry opportunity costs—the same money could be invested in employment creation, establishing protected areas, etc. Even though complete economic valuation will only rarely be possible or necessary, it is always important to thoroughly examine options from an economic perspective.

[135] UNEP-WCMC, 2003.
[136] Simberloff et al, 1992.
[137] Zuidema et al, 1997.
[138] Liu and Taylor, 2002.

4.2. A Capacity for Learning by Doing

The above consideration may suggest a need for heavy planning processes, but this should be avoided at all costs. It is much better to start immediately with a few experimental restoration activities on the basis of outcomes of the initial discussions amongst stakeholders. These trials will establish the credibility of outside stakeholders and will permit learning. They will greatly enrich ongoing stakeholder negotiations that should continue throughout the programme. The initial objective should be to build a community of interest groups that can experiment and learn together.

A sense of community or "social capital" can really enhance efforts to restore landscapes. Voluntary groups have accomplished some remarkable restoration achievements. People can work together and develop a shared passion for restoring the habitat of a rare animal or the beauty of a disfigured landscape. Such communities will fine-tune their objectives and adapt their programmes as they advance. They will provide an excellent mechanism for setting and updating goals and end points.

To get real "buy-in" from diverse interest groups, it is important to start small, provide outside inputs as drip-feeding, not as big cash injections, avoid setting up bureaucracies, and learn and adapt as you progress.

4.3. Tracking Tools for "Landscapes"

As restoration programmes unfold it is essential to have feedback mechanisms so that success can be assessed, stakeholders consulted, and activities adapted to reflect changed perspectives. Such tracking tools (or monitoring and evaluation) need to be negotiated at the beginning of the process to ensure that they genuinely track the attributes of the site that people value. Since landscapes are complex and stakeholders' views often divergent, such tracking tools will inevitably be complicated.[139]

[139] See penultimate chapter in Sayer and Cambell, 2004.

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Case Study: Madagascar: Developing a Forest Landscape Restoration Initiative in a Landscape in the Moist Forest

Stephanie Mansourian and Gérard Rambeloarisoa

Starting in March 2003, WWF, the global conservation organisation, and its partners began developing a Forest Landscape Restoration programme in the moist forest ecoregion of Madagascar. This case study highlights the different steps in the process.

Only about 10 percent of Madagascar's forests are left, and much of this is in poor condition. For this reason forest landscape restoration was identified as a useful approach to tackle conservation and development concerns in the country. In March 2003, when WWF began its restoration programme, a moist forest ecoregion process was already underway to develop a comprehensive conservation programme for the whole area (i.e., data were being gathered, maps developed highlighting key habitats, the range of different species were being surveyed, etc.) which helped to feed crucial data into the development of the restoration initiative.

The key steps in the development of the restoration programme are as follows:

1. Short-listing priority landscapes (March 2003): In a national workshop with participants representing civil society, researchers, government, and the private sector, a number of potential landscapes were selected for restoration based on coarse criteria developed together in the workshop.

2. Reconnaissance to focus on one landscape (June–August 2003): The criteria were then further refined by a national working group set up at the workshop. Using the selected criteria (which included both ecological and social issues, for instance, distance from large forest patch, literacy rate, presence or absence of land tenure conflict), the members of the national working group visited the five short-listed landscapes and rated each according to the criteria in order to select one priority one.

3. Proposal development and funds raised (August 2003–June 2004): A proposal was developed, submitted, and approved for the priority landscape.

4. Beginning the process for selecting biological and ecological targets (June 2004): To begin identifying the biological and ecological priorities for the landscape, data from the ecoregion process was used to define what might be priority areas for restoration within the landscape and with which biological/ ecological objective (e.g., restoring the habitat for a specific lemur, buffering a protected area, etc.).

5. Socioeconomic analysis (September–December 2004): Before taking the biological data further, it was felt that a better understanding of the social and economic situation inside the landscape was needed, leading to the commissioning of a socioeconomic analysis.

Next Steps

Some of the key next steps that have been already identified include the following:

- Setting common targets in landscape: Using a merge of the ecological and the socioeconomic data, it will be possible to identify "compromise targets" for the landscape in consultation with stakeholders.
- Partnerships: Key partnerships with stakeholders will be important to the process, from a point of view of both political support and technical complementarity.
- Setting up a monitoring system at the landscape level: To measure progress against those targets, a monitoring system will need to be set up.
- Beginning small-scale activities: Small-scale activities need to start rapidly to identify the most suitable techniques, species, species' mix, training needs, and alternative economic activities that the population can engage in.
- Extracting lessons learned from the process and revisiting the work plan: On an annual basis, it is necessary to revise work plans and review data to determine whether the process is progressing according to plan or if adjustments are necessary.

15 Identifying and Using Reference Landscapes for Restoration

Nigel Dudley

Key Points to Retain

Reference forests are carefully preserved natural or near-natural forests that can provide information about natural species' mix and ecology, that can be used in planning and measuring the success of restoration.

Formal and informal networks of reference forests are building up around the world.

Use of reference forests often needs to be supplemented with other data such as historical records, old maps, identification of past vegetation through pollen mapping from peat cores, etc.

1. Background and Explanation of the Issue

Because forest restoration is a process, a good restoration programme starts with a fairly clear idea of what type of forest is being created, that is, the *target* for restoration and the associated activities. This can only be approximate, because ecosystems change and evolve, but can help set the approach and time scale.[140] There can be many different aims and end points, for instance:

- Restoration of deforested land with a staged process leading to a more natural forest over time, e.g., as in Guanacaste, Costa Rica, where exotic species are used as nurse crops for natural forest[141]
- Restoration of forest with specific social values, e.g., *tembawang* fruit gardens of western Borneo, which are planted for their nontimber forest products but are also high repositories of biodiversity
- Restoration of specific values within managed forests by specific interventions, such as re-creation of dead wood components in southern Swedish and Finnish forests
- Restoration as a centuries-long process, where initial intervention is then augmented by natural changes and aging, as in the previously deforested *Agathis* forests of northern New Zealand

Although it is often assumed that restoration aims to re-create a "natural" forest, this is not always the case. Many efforts aim instead at culturally important forests, as in parts of the Mediterranean, or even seek to limit the spread of trees to maintain game animals, as in many of the eastern African savannahs. Whatever the aims, good restoration needs to be planned and monitored against some framework, usually a similar forest type that identifies a template for the type of forest being restored.

Reference forests provide a model to follow. The best reference forests are those that have

[140] Peterken, 1996.

[141] Janzen, 2002.

been identified, protected, and monitored over time, so that they have an associated body of understanding about their ecology. They will often, although not invariably, be old forests, although younger forests can provide valuable reference for successional stages. Even quite newly identified reference forests can provide valuable information if their history is known and it will often be necessary to find a reference forest or reference landscape as part of the planning for forest restoration at a landscape scale. Sometimes reference forests need to be re-created theoretically from historical records and pollen diagrams. Although most valuable in relating to forest types in the same ecosystem, reference forests also provide information of value to forests far away. It is important to understand the relationship between the historical reference forest and the future forest being re-created or modified; the reference forest is not necessarily the same as the target forest being restored. Sometimes it will be possible, over time, for the latter to become very similar to its reference, while in other cases this will be impossible either because of other pressures on and needs from the forest or because conditions have changed and certain elements of the original forest are irrecoverable. A clear understanding of this relationship is important when setting targets for restoration.

Reference landscapes provide information on different aspects of ecology, particularly composition, ecological processes and functioning, and, crucially but often the most difficult to pinpoint, cyclical changes over time. Locating forests undisturbed enough to exhibit natural changes either through a gradual process of aging and renewal or from evidence of natural catastrophic events is now increasingly difficult in many areas, yet an understanding of how forests renew themselves is important in re-creating near-to-natural forests and in understanding likely pressures on managed forests.

Other elements to consider in defining targets for restoration include long-term human interaction with forests and the evolution of cultural landscapes (many forests have never existed without the presence of humans so that the idea of a pristine, human-free ecosystem is often little more than a myth). The probability of future climate change and other forms of environmental disturbance means that targets should be tailored with this in mind, also suggesting the limitation of following reference landscapes too closely, when they may be undergoing change themselves. More generally, targets for restoration should be developed with an understanding of likely changes. The idea that vegetation evolves to some climax type and then stays the same is now largely disproved, at least at the level of a particular stand, where flux is expected and is likely to be constant. In the end, choices usually need to be made about levels of biodiversity, naturalness, and livelihood values contained in particular restored forests, and reference forests can only provide information to help with these more political choices.

2. Examples

The presence of reference forests has played a fundamental role in understanding forest ecology and in developing responses to forest loss and degradation. Some reference forests are outlined below.

2.1. Oregon, United States

The H.J. Andrews Experimental Forest was protected by the U.S. Forest Service in 1948 as part of a network of forests intended to serve as living laboratories for studies by the service's scientific research branch. The forest is administered cooperatively by the U.S. Department of Agriculture (USDA) Forest Service Pacific Northwest Research Station, Oregon State University, and the Willamette National Forest, with funding from the National Science Foundation, U.S. Forest Service, Oregon State University, and others. Long-term field experiments have focussed on climate dynamics, stream flow, water quality, and vegetation succession. Currently, researchers are working to develop concepts and tools needed to predict effects of natural disturbance, land use, and climate change on ecosystem structure, function, and species' composition. Over 3000 scientific publications have used data from the forest. The research has been used in developing ways of restoring old-growth characteristics within managed forests in the Pacific Northwest through "new forestry," including retention of standing dead wood and coarse woody debris in streams.[142]

2.2. Centre for Tropical Forest Science (CTFS), Smithsonian Institute, Washington, DC

The CTFS has developed an international network of standardised forest dynamics plots. Within each plot, every tree over 1 cm in diameter is marked, measured, plotted on a map, and identified according to species. The typical forest dynamics plot is 50 hectares, containing up to 360,000 individual trees. An initial tree census and periodic follow-up censuses yield long-term information on species' growth, mortality, regeneration, distribution, and productivity, which currently provides an almost unique information source for developing restoration strategies within managed tropical forests. Utilising the data from the standardised, intensive forest dynamics plots throughout the tropics, CTFS researchers are exploring tropical forest species' diversity and dynamics at a global scale. Plots currently exist in Panama, Puerto Rico, Ecuador, Colombia, Cameroon, Democratic Republic of Congo, Malaysia, Thailand, Sri Lanka, India (see below), the Philippines, Singapore, and Taiwan.

2.3. India

The Mudumalai Wildlife Sanctuary and Bandipur National Park are part of the wildlife-rich protected areas within the Nilgiri Biosphere in the Western Ghat Mountains of southern India. These reserves are sites of long-term ecological research by the Centre for Ecological Sciences. A 50-hectare permanent plot in Mudumalai, where the dynamics of a tropical dry forest is investigated in relation to fire and herbivory by large mammals, is part of the international network of large-scale plots coordinated by the CTFS (see above).

[142] Luoma, 1999.

2.4. Europe

Under the auspices of the European Cooperation in the Field of Scientific and Technical Research (COST) programme of the European Commission, a network has been established to help coordinate research taking place in strict forest reserves in 19 European countries. The process established protocols for data collection both in a core area and over the whole reserve, primarily to develop repeatable methods of describing the stand structure and ground vegetation. A Web-based forest reserves databank is helping to coordinate information. Natural forests are perhaps more critically threatened in Europe than in any other region, and the information will be used to help identify and manage protected areas and increase component of naturalness in managed forests.[143]

2.5. Mediterranean Europe

In some cases, changes have progressed so far that fully natural or near to natural reference forests have been lost. The origin of many of the fruit trees commonly found in Mediterranean forests is often only very generally known for example. Here the most useful references are often old cultural forests that contain many elements of biodiversity, and restoration programmes often aim to re-create these.[144]

Changes in access to reference forests can dramatically increase our level of understanding of forest dynamics and therefore management options. For example, when Finnish forest ecologists gained access to more natural forests in the Russian Federation at the end of the 1980s, they revised their understanding about disturbance patterns, recognising that snow damage was a proportionately larger agent of change than had been suspected. However, reference forests seldom provide *all* necessary information, particularly when changes have been so profound that no natural forest remains. Living reference forests are therefore a useful tool but by no means the only method

[143] Broekmeyer et al, 1993.
[144] Moussouris and Regato, 1999.

for determining targets. Some of the other tools that may be used as surrogates for living reference forests are outlined below.

3. Outline of Tools

In most cases, reference landscapes are developed using a suite of different tools, the main ones of which follow:

- Reference forests: As described above, these are probably the most valuable single source of information.
- Comparison with other ecologically similar forests: Even if no nearby forests exist to act as a reference, use of cumulative data around the world can help to build our understanding about a forest's ecology. For example, knowledge about breeding patterns and population in many birds of prey allows ornithologists to make reasonably good predictions about stable reproduction rates for species based on body weight. Understanding about forest fire ecology can, with caution, be transferred from one ecosystem to another, at least to develop working hypotheses. Other elements, such as old growth characteristics, have been found to translate rather poorly from one forest ecosystem to another.
- Comparison with "original" forest types: Although it is often impossible to find a wholly unaltered forest ecosystem, numerous well-thought-out attempts have been made to describe ancient or natural forests: some examples are given in Table 15.1.
- Historical records: Written records can tell us a great deal and sometimes stretch back for hundreds or even thousands of years. The oldest known written records of forest management are 2000 years old and refer to forests maintained to supply timber for Shinto temples in Japan. Records from written histories, religious scriptures, sagas, and trade accounts can all provide valuable, albeit usually fragmentary, information about forests. Many supposedly "natural" forests in the U.K. can be traced back to recorded planting (often with the names of the people who planted them). More recent travellers' accounts are frequently used to provide information on past vegetation patterns, such as the records kept by Italian travellers in Eritrea a century ago that

TABLE 15.1. Definitions of original forests.

Definition	Explanation
Ancient woodland	Woodland that has been in existence for many centuries: precise time varies but in the U.K., 400 years is commonly used[1]
Frontier forest	"Relatively undisturbed and big enough to maintain all their biodiversity, including viable populations of the wide-ranging species associated with each forest type"; criteria include primarily forested; natural structure, composition, and heterogeneity; dominated by indigenous tree species[2]
Native forests	Meaning is variable: often forests consisting of species originally found in the area—may be young or old, established or naturally occurring, although in Australia often used as if it were primary woodland[3]
Old-growth in the Pacific Northwest, United States	"A forest stand usually at least 180–220 years old with moderate to high canopy cover; a multi-layered multi-species canopy dominated by large over-storey trees"[4]
Primary woodland	"Land that has been wooded continuously since the original-natural woodlands were fragmented. The character of the woodland varies according to how it has been treated."[5]
Wildwood	"Wholly natural woodland unaffected by Neolithic or later civilisation"[6]

[1] Bunce, 1989.
[2] Bryant et al, 1997.
[3] Clark, 1992.
[4] Johnson et al, 1991.
[5] Peterken, 2002.
[6] Rackham, 1976.

now provide information for restoration activities.

- Forest fragments: Even quite unnatural forest fragments or remnant microhabitats can with care and caution, be used as partial surrogates in areas where full reference forests no longer exist. For instance, park land and hedgerows both contain important elements of natural forests in Western Europe and can help set targets for restoration. Similarly sacred sites, preserved for religious reasons, can contain species that have disappeared from the surrounding area, as in forest gardens and sacred groves in, for instance, Indonesia, Laos, China, Kenya, and Malawi.
- Pollen analysis and soil microcarbon analysis: Analysis of pollen in peat cores, lake beds, or soil profiles can identify plants from thousands of years ago, as pollen is highly resistant to decay, particularly in the anaerobic conditions found in peat, and can often be identified to the level of individual species. Analysis along a core can show how vegetation changed over time, the presence and frequency of fires, and sometimes information about pollution. Such analysis is often the only sure way of building a picture of past vegetation where changes have been dramatic and living reference landscapes have disappeared.
- Gap analysis using enduring features: This approach consists of a coarse-filter conservation assessment of protected areas based on a landscape approach using "enduring features" (essentially land forms or physical habitats) as geographic units that reflect biological diversity. The gap analysis involves three main stages. First, natural regional frameworks are reviewed to ensure that natural region boundaries reflect broad physiographic and climatic gradients. Next, within each natural region maps are used to identify enduring features. An enduring feature is a land form or landscape element or unit within a natural region characterised by relatively uniform origin of parent material, texture of parent material, and topography-relief. Finally, the relationship of biodiversity to enduring features of the landscape is derived from more detailed tertiary sources.[145]

4. Future Needs

Although a lot of the tools are in place, there is still little experience in combining them to develop realistic targets for restoration exercises. Gaps go right back to the philosophical roots of restoration and at what is being aimed for—for example, original vegetation or just a workable ecosystem at the present time. Much better understanding of the likely process of forest restoration itself is needed, along with more accurate methods of measuring progress.

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16
Mapping and Modelling as Tools to Set Targets, Identify Opportunities, and Measure Progress

Thomas F. Allnutt

Key Points to Retain

Forest landscape restoration can benefit from mapping and use of geographical information systems (GIS) in several key ways, but in particular by measuring and monitoring progress toward meeting biological and socioeconomic targets via restoration.

Many potential methods exist to utilise maps and GIS for landscape-scale restoration, from the simple to the highly customised and experimental.

1. Background and Explanation of the Issue

Successfully planning, implementing, and monitoring projects that aim to restore forest landscapes involves the management and analysis of spatial information, that is, quantitative and qualitative two-dimensional data covering the area of interest. For example, understanding how a potential restoration site may or may not meet a biodiversity goal such as "increase overall habitat connectivity from x to y to maintain the viability of species z" requires maps and basic statistics (size, isolation, etc.) for all forest patches that occur across the landscape. Many other spatial variables influence the suitability and likely success of a given area for restoration. Therefore, map-based technologies, such as satellite remote sensing, aerial photography, and geographic information systems (GIS) have and will continue to provide many benefits to forest landscape restoration.

There are many ways GIS and other spatial technologies can assist forest landscape restoration projects. At one end of the spectrum, simple maps of forest cover, elevation, rivers, communities, and roads are inherently useful for understanding the ecological and human context of the landscape. At the other extreme, sophisticated and custom spatial models may be constructed to simulate, for example, the hydrological effects of forest restoration on downstream watersheds. Here we focus on the use of spatial data to develop spatial scenarios that meet biological and socioeconomic targets. Known as "suitability modelling" or "multicriteria evaluation," this approach is one type of GIS-based modelling utilising readily available commercial GIS packages.

Specifically, in this chapter we provide (1) examples of the types of spatial data and some common map-based measures useful for planning and monitoring restoration of forest landscapes, (2) examples of spatial tools and technologies for deriving this information, and (3) reviews of several recent applications of spatial technologies to restoration.

1.1. Mapping Areas to Meet or Set Targets

The targets and goals of the project determine the types of spatial data to collect and spatial analyses to conduct. There are two main types of targets, biological and socioeconomic. Although not all targets are spatial in nature (e.g., "prevent the extinction of species x"), many are. Some examples of spatial targets include "Protect x hectares of habitat y" or "Establish x hectares of community forest reserves." Planning for and evaluating progress toward a target such as the latter type requires appropriate spatial data.

1.1.1. Biological Targets

Often, biological targets are derived directly from existing large-scale conservation planning processes such as ecoregion conservation (ERC).[146] An initial product of an ERC vision is a set of priority landscapes designed to meet specific biological objectives, such as the conservation of an endangered primate. Where this is the case, these targets can be used directly to prioritise and implement restoration areas, for example, preferentially conduct restoration adjacent to known populations of the target primate.

In other cases, no such information may exist. Here, participants may rely on basic principles of biological conservation to guide what targets to select, and thus what spatial data sets are needed. In general, space-based biological targets involve individual species (e.g., cheetah),[147] habitat, or vegetation types (e.g., wetlands), or ecological and evolutionary processes (e.g., migration, hydrology).[148] Targets for these features are typically expressed as quantitative areas or percentages of the total distribution of the biological element in question (e.g., 1000 hectares of oak-savannah).

Once biological targets are established, several classes of spatial data are necessary to map where they may be achieved on the ground. In many cases, existing map sources may be used; in others, maps will have to be created using modelling or technologies such as remote sensing.

To evaluate species-based targets, one first needs to know the current distribution of all target species within the landscape at the finest level of detail possible. Range maps are one potential surrogate for this information and they are increasingly available for a number of taxa worldwide.[149] In other cases, modelling may be used to predict species' distributions from field collections coupled with environmental data.[150] Often, and particularly at fine scales, field-based inventories will be required to assess the presence or absence of certain key species.

Another common type of biological target involves particular habitat and/or vegetation types. Several sources of data are available to evaluate this type of target. Existing maps and classifications are often used, from national or regional inventories, for example. In other cases, new maps may be created from raw photographs or the processing of photographs or digital images. The most widespread source is remote sensing—typically photographs or digital imagery from airplanes or satellite-borne sensors. New, high-resolution imagery (submetre) provides a good source for mapping natural habitats as well as human land uses, though cost can be a significant constraint.

In areas of high species and habitat heterogeneity, optical remote-sensing may not be able to distinguish biological differences to a necessary degree. Forest that is indistinguishable spectrally—from the perspective of a camera or satellite—is often very diverse biologically. Here, habitat modelling can be used to map areas where one expects species to differ significantly. A range of approaches are available, from the quick and approximate, to more formal statistical methods.[151] Elevation, for example, is often used as a proxy for species' distributions, and can be used to quickly divide a continuously mapped forest type into several or more forest habitats (lowland, sub-montane, montane, etc.).

146 Dinerstein et al, 2000.
147 Lambeck, 1997.
148 Pressey et al, 2003.
149 Ridgely et al, 2003.
150 Boitani et al, 1999.
151 Ferrier et al, 2002.

The spatial configuration of the restoration landscape is of critical importance for biodiversity conservation for several reasons. One, the long-term survival of many species often depends directly on the size and connectivity of available habitat. The reasons for this are generally (a) individuals and populations require sufficient outbreeding opportunities that are only available in habitat blocks of a particular size, and (b) the species in question has ecological requirements (e.g., seasonal migration) that require large connected blocks of habitat. In both cases, research may be necessary to assess the habitat configuration necessary for the target species. Two, many environmental and ecological processes will not be maintained once habitat fragments drop below a particular threshold of isolation or fragmentation. The maintenance of natural hydrological flows in watersheds, for example, can depend on the size and connectivity of intact forest blocks.

1.1.2. Socioeconomic Targets

The second major class of targets are socioeconomic. In some cases, socioeconomic targets will have been specified when the landscape was identified within a priority setting exercise (e.g., the visioning process in ecoregion conservation), though this is less often the case than with biological targets. Socioeconomic targets that require spatial data generally specify target amounts of land uses within the landscape. This may involve zoning one portion of the landscape for a particular land use. For example, participants may wish to have one third of the landscape devoted to community forestry. In other cases, the entire landscape (apart from those areas reserved for biodiversity conservation) may be zoned for particular land uses, akin to a traditional land-use plan or zoning map.

Mapping areas to meet socioeconomic targets requires a detailed and up-to-date land-cover map. This map shows the current distribution of natural and human-oriented areas in as much detail and at as fine a scale as possible and it can be derived from existing land-use/land-cover maps for the area, or may be created from aerial and remote sensing sources coupled with ground truth. The map of current land uses serves as the starting point; a map of future land uses shows those areas where changes in land uses will be necessary to meet socioeconomic targets.

1.1.3. Land Tenure and Land Value

The legal status and ownership of land (land tenure) within the landscape, and the economic value of that land are also important for planning forest landscape restoration. Sometimes this information can be derived from existing maps available from local or national government organisations, particularly in the case of land tenure. In other cases, ground surveys will need to be conducted to establish tenure and land value of unknown areas. Spatial economic modelling has also been used to estimate land value. Rules are constructed that allow one to estimate the value of every parcel of land within the area of interest, based on variables such as market access, for example.

1.3. Mapping Opportunities: Integrating Biological and Socioeconomic Data to Meet Targets and Map Opportunities

Some areas are more suitable than others for particular uses. Analysis of spatial data has the potential to efficiently allocate areas to one use or another. This idea is formalised in land-use plans or more formally via suitability modelling otherwise known as multicriteria evaluation (MCE).[152]

Suitability modelling or MCE using GIS can be used to systematically combine spatial, biological, physical and socioeconomic data detailed above in order to meet biological and socioeconomic objectives via restoration. Here are two generic examples:

1. Map suitability for a single biological or socioeconomic target. As an example, imagine

[152] Eastman et al, 1993.

one biological target for the landscape is to maintain a viable population of a primate. It is estimated that the target primate requires 25,000 hectares of habitat between 1000 and 3000 m in elevation, in a single, connected block of forest. There are currently only 15,000 hectares of suitable forest within the landscape, in two disconnected blocks. Therefore, the challenge is to map at least 10,000 hectares to restore based on the habitat criteria required for the species: elevation, size, and connectivity. Three maps are created. One shows all areas in the target range of 1000 to 3000 m, one ranks areas according to their potential to rejoin the disconnected blocks, and one ranks areas by their proximity to existing good habitat for the primate. These three maps are standardised to a common numeric range, and then combined by means of a weighted average, to produce a continuous map of suitability. The most suitable areas are those that are close to existing intact habitat, connect the two blocks, and are the right elevation. The highest scoring areas (those that come close to meeting all three criteria) are selected until the target of 10,000 hectares is met. These form the priority restoration areas for this biological target. The same process may be used to map suitable areas for socioeconomic targets.

2. Incorporating socioeconomic data as a constraint on suitable areas for biological targets. Just as physical and biological criteria may be combined to identify suitable restoration areas to meet biological targets, socioeconomic criteria, such as land use or land value, can also be incorporated in the process. For example, imagine two parcels of land that, when restored, would be equal in every way for meeting the above biological target. They are equivalent in elevation, in proximity to existing forest, and in terms of connecting the two forest blocks. One parcel is currently actively used for agricultural production, whereas the other has been abandoned for several years. For several reasons, it would likely be easier to restore the abandoned parcel. Thus, including socioeconomic data in the MCE process can help to efficiently identify restoration priorities when there are choices of areas to meet biological targets.

1.4. Monitoring

A key benefit of using quantitative spatial data and targets for both biological and socioeconomic variables throughout the planning and implementation process is that it facilitates long-term monitoring as the project proceeds. Remote sensing in particular provides a relatively quick and inexpensive, synoptic, repeatable view of large-scale changes to land uses and land cover over time within the landscape. Clearly this will have to be paired with reviews of progress toward those biological and socioeconomic targets that cannot be measured remotely. A current disadvantage is the lack of long-term large-scale attempts at systematic monitoring of conservation programmes, though efforts are currently underway at a number of places and institutions.

2. Examples

Examples abound of the use of maps and GIS in the fields of planning and conservation.[153] Generally speaking, however, there are few examples of its application to forest restoration planning. One exception is the recent work of J. Halperin, in which GIS was used for participatory, community-based, large-scale restoration planning in Uganda.[154]

The WWF network has only recently begun to apply GIS to its restoration initiatives. The United Nations' Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC) used GIS to prioritise areas for WWF-based restoration projects in North Africa.[155] Biological attributes such as species' richness, forest integrity, and patch size were balanced against human pressures including road density, grazing pressure, and resource use. As of early 2004, there are two additional projects underway. In one, in the Andresito landscape (Argentina) of the Atlantic Forest, there are plans to use suitability modelling with IDRISI to identify key restoration corridors in

[153] see e.g., Eghenter, 2000; Herrman and Osinski, 1999.
[154] Halperin et al, 2004.
[155] UNEP-WCMC, 2003.

conjunction with a set of stakeholders from the region. Similarly, GIS is being used in Madagascar to map and prioritise suitable areas for restoration within a large landscape that needs to be restored. Here, biological targets are being established for six IUCN red-listed vertebrates. Criteria are being established to map suitable habitat for each species in order to evaluate current status within the landscape. Where current habitat is insufficient for long-term viability of each population, areas will be prioritised for restoration based on connectivity, proximity to known populations, and habitat characteristics. Socioeconomic data will be used as a constraint where options exist to meet biological targets. This work is in its initial stages and is expected to continue through 2005.

3. Outline of Tools

Standard vector-based GIS software—ESRI (ArcMap, ArcView, Arcinfo)—is the standard GIS virtually worldwide. It is available at low cost to conservation organisations, and it performs all types of GIS functions, from basic mapping to advanced analyses, especially when customised or linked to other programmes (e.g., statistical software, etc.).

Standard raster-based GIS—IDRISI, ESRI (Spatial Analyst, GRID for Arcview, ArcMap, and Arcinfo), ERDAS. The IDRISI and ESRI products are low cost (for educational or non-profit companies) GISs capable of doing raster-based analyses (e.g., most analyses involving remotely sensed imagery). IDRISI includes functions for easily stepping through suitability models and MCE as part of its decision support package. ERDAS is a much more expensive software designed primarily to analyse satellite imagery and other remotely sensed data.

4. Future Needs

A key need is for participatory GIS-based decision-support tools designed specifically for restoration in a biodiversity conservation context. Similarly, research is needed into tools to strengthen linkages between site-based restoration research and spatial decision making with GIS. Recently, several new GIS models are in use that have been used extensively for spatial planning in conservation, notably C-Plan[156] and SITES/Marxan.[157] These particular applications are currently, generally speaking, spatial optimisation tools designed to meet representation targets in conservation plans. There is tremendous potential, however, especially with the simulated-annealing algorithm used by Marxan (and now SPOT among other tools) to optimise any given set of objectives (such as restoration) in a spatial model. Research is urgently needed to expand these tools to meet other objectives beyond simple reservation and representation.

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17 Policy Interventions for Forest Landscape Restoration

Nigel Dudley

Key Points to Retain

Changing policy toward restoration or land use is often the most effective way of stimulating large-scale restoration.

Such policy changes can be addressed, in different ways, at a local scale (e.g., changing grazing patterns), a national scale (e.g., modifying forestry laws), or a global scale (e.g., ensuring that international conventions favour high-quality restoration).

Key tools in policy interventions include good analysis, especially economic analysis, case studies, and advocacy.

1. Background and Explanation of the Issue

Localised and site-based interventions to restore habitat can be very useful, and much of what we have learned about ecological restoration comes from small-scale initiatives, primarily carried out by nongovernmental organisations (NGOs) and local communities but also to an increasing extent by forward-looking companies and government departments. We also describe further in this book (see "Practical Interventions that Will Support Restoration in Broad-Scale Conservation Based on WWF Experiences") how strategic use of such initiatives can have wider benefits, for example by linking patches of existing habitat, by providing fuelwood to places that are otherwise without energy sources, or by preventing erosion. However, small-scale initiatives are inevitably limited in what they can achieve on their own and are usually expensive, stretching the resources of the organisations or communities that carry them out. Accordingly, it is often more effective to spend effort in changing policies at local, provincial, national, regional or even global level to encourage restoration at a broader scale. Many NGOs undertake restoration initiatives to use them as a lever to change policies, by, for example, showing that different approaches can be more effective or cost less money. But although working examples can be powerful tools in stimulating change, they usually need to be accompanied by effective advocacy and a thorough understanding of the policy climate.

Policy change can operate at many different levels. At the most local level, it can include changing policies within a single community[158] or landscape to stimulate forest restoration. Examples include:

- Agreed changes in grazing regimes to allow natural regeneration, perhaps agreeing to protect different zones at different times
- Voluntary controls on collection of nontimber forest products to ensure that these are not degraded

[158] Sithole, 2000.

- Collective investment in tree planting, for instance to establish fuelwood plantations

Whilst such interventions are already a regular feature of many large conservation or conservation and development projects, they are again quite limited in scope. A far more significant change can be affected if national policies are changed in favour of more sympathetic restoration, for example:

- Modification of national forestry laws to allow old-growth forest to remain, facilitate retention of deadwood, or remove perverse incentives that discourage restoration
- Changing national forest restoration or afforestation programmes to increase the range of goods and services that they provide (for example, reducing the proportion of intensive plantations and increasing assisted natural regeneration)

There are also increasingly opportunities to change policies that transcend national borders,[159] thus potentially having an impact on a global or a regional scale. Along with intergovernmental bodies, such transnational policy can also involve companies that operate in many countries or bilateral and multilateral donors, including the following:

- Introduction of pro-restoration clauses within international treaties or incentives, such as using carbon offsets for forest restoration under the U.N. Framework Convention on Climate Change, or specific policy recommendations of global forest initiatives such as the U.N. Forum on Forests
- Integration of restoration into funding opportunities or legislative requirements from regional agreements such as those of the European Community
- Development of company policies for restoration after mineral extraction, infrastructure developments, etc.
- Modification of projects funded by bilateral or multilateral donor agencies

[159] Tarasofsky, 1999.

2. Examples

2.1. Altai Sayan, Russia

Russia's first woodland area to be certified under the Forest Stewardship Council is still managed collectively and includes large areas of woodland on sandy soils dominated by birch—used for specialist products sold by the Body Shop chain. The certification process included agreement by farming cooperatives on changes in sheep grazing to leave some areas untouched for long enough to foster regeneration of birch woods.[159a]

2.2. Latvia

Latvian forestry inherited legislation crafted by the Soviet Union, which included the use of large clearcuts and a requirement to manage forests including removal of deadwood. As a result, dead standing and lying timber is in short supply in many woodlands, leading to a decline in many saproxylic (deadwood living) species.[160] This is particularly serious at a European scale because Latvia's forests contain some of the richest biodiversity in the continent. WWF in Latvia has worked with the government to change the forestry regulations to allow retention of deadwood in managed forests, thus opening the opportunity of increasing this threatened microhabitat.

2.3. Vietnam

The government's five million hectare reforestation programme aims to restore forest cover but in practice hampers local flexibility. Although large plantations have been established, it seems likely that in several provinces much money has been wasted in places where forest cover remains high. In theory funding can be used to support natural regeneration, for example in the buffer zones of protected areas, as is already happening around Song Thanh Nature Reserve. The WWF Indochina Programme is working with the government to

[159a] Information drawn from site visit as part of certification team, 1998.
[160] Rotbergs, 1994.

modify the way in which funds are used, both to increase natural forest restoration and to ensure that established forests are retained and gain higher value (see detailed case study "Monitoring Forest Landscape Restoration in Vietnam").

2.4. European Community

Throughout the European Union (EU) region, restoration of natural woodlands is hampered in areas of sheep or goat grazing because farmers receive hectare-based payments depending on the area capable of being grazed.[161] To obtain maximum funds, woodlands are opened to grazing, which means that young seedlings fail to establish, resulting in gradually aging forest. In some cases, woodlands that have been fenced with EU funds to encourage regeneration are now being opened up again. It is recognised that the key to facilitating regeneration in many areas is not further grants for tree planting but a removal of perverse incentives (see "Perverse Policy Incentives" and case study "The European Union's Afforestation Policies and their Real Impact on Forest Restoration") by changing incentives' schemes within the Common Agricultural Policy to reduce the reasons for allowing sheep grazing in woodlands.

2.5. Central America

The Kyoto protocol of the U.N. Framework Convention on Climate Change allows for governments to offset some of their carbon emissions, or trade other countries' emissions, through tree planting. Initial proposals focussed largely on the establishment of intensive plantations of exotic species, but research suggests that the long-term carbon sequestration benefits of such plantations are very limited, as they are used mainly for short-term products such as paper and cardboard that are quickly abandoned and break down. Central American governments have been amongst those most active in lobbying for modification of the Kyoto protocol to allow different kinds of forest management including natural regeneration and increase of retention of deadwood and humus components. Research suggests that innovative use of carbon markets has aided forest regeneration, with the side benefit of also increasing tourism in these areas.[162]

2.6. Lafarge—Quarry Restoration in Kenya

Lafarge, based in France, is now the largest quarrying company in the world. The development of its policy toward forest landscape restoration is an example of how small-scale interventions can lead to larger restoration policy initiatives.

Lafarge's forest restoration work started with a series of site-based interventions. The former quarry of the Bamburi cement plant near Mombasa in Kenya was mined for 20 years. In the early 1970s, a rehabilitation programme was started to restore the site as a nature reserve. After a phase of soil formation using the leaf litter of introduced pioneer trees, a large number of tree and other plant species typical of the indigenous coastal forests were also planted. The success of these was observed over time in order to select those species that proved suitable for planting on a larger scale to replace the pioneer trees. In addition to trees of potential economic value (such as Iroko and other indigenous hardwood, which is valuable for local crafts such as carving), endangered species and those that provide habitat or food for indigenous wildlife have also been planted: to date, 422 indigenous plant species have been introduced into the newly created ecosystems of forests, wetlands, and grasslands in Bamburi's former quarries. Of these 364 have survived, including 30 that are on the IUCN Red List of Threatened Species for Kenya.

Lafarge also started working with WWF on policy issues, including supporting the organisation's forest landscape restoration initiative. In April 2002, Bamburi signed a partnership agreement with WWF East Africa, and identified forest landscape restoration as one of the priority partnership activities, including the

[161] Joint Nature Conservation Committee, 2002.

[162] Miranda et al, 2004.

need to establish a biodiversity monitoring system in partnership with WWF, in order to define guidelines for ecological quarry rehabilitation.

In 2001 Lafarge adopted a formal quarry rehabilitation policy with the participation of WWF to spread best practice in terms of quarrying work and relations with local stakeholders. The most important elements of this policy are to plan restoration from the outset and coordinate restoration with quarrying activities. In addition to biodiversity issues, land planning considerations are also taken into account when defining a rehabilitation project in order both to preserve the environment and to generate income for the local communities. In this framework quarry rehabilitation often leads to the creation of wetlands and natural reserves or leisure areas.

3. Outline of Tools

Stimulating policy changes requires hard and convincing analysis, including economic analysis, a clear message, and sometimes some targeted and effective advocacy. In cases where financial support is being changed around in favour of more balanced forms of restoration, it may also include economic incentives. Some key tools are as follows:

Economic analysis is useful to make the case for restoration or for different kinds of restoration. Examples might include demonstrating that retention of deadwood within managed forests does not entail excessive cost, or showing that natural regeneration is cheaper than replanting. For example, a WWF/World Bank economic analysis convinced the government of Bulgaria to change plans for establishing intensive poplar plantations on islands in the Danube with natural regeneration,[163] and an analysis for Forestry Commission economists in Wales, U.K., persuaded the government agency to use natural regeneration in an area of forest because it proved cheaper than replanting.

Economic incentives encourage individuals and groups to make space for restoration, including both official incentive schemes and incentives through the market, such as certification. Targeted incentives have been used very successfully to encourage restoration, for instance through conservation easements to take land out of production, as has occurred widely in the U.S., through direct support for tree planting as successfully implemented on a large scale in parts of Pakistan, or through tax incentives as in several Latin American countries.[164]

Case studies show that restoration can work and pay for itself. The case of the restored quarry near Mombasa showed that restoration was not an impossibly expensive task and helped to encourage Lafarge, the company concerned, to introduce a wider policy. Case studies only work, however, if they are carefully prepared and include all the relevant information needed to make policy decisions, and if they reach the attention of the right policy makers.

Advocacy entails campaigns or lobbying to encourage change.[165] Targeted lobbying has been successful, for example, in changing some conditions in the Kyoto Protocol to allow greater latitude for natural regeneration.

Codes of practice are developed by working with other stakeholders (e.g., industry) to agree and implement them voluntarily and to encourage restoration. The International Tropical Timber Organisation recently completed detailed guidelines for natural regeneration, in association with IUCN and WWF, which provide an example of this approach.[166] As with case studies, however, such codes are only worth the investment in developing them if they are implemented in practice.

4. Future Needs

Many of these ideas remain in their infancy. We still require far better understanding of the economic and other benefits of environmental goods and services from restoration in order to make the case, for example, for natural regen-

[163] Ecott, 2002.

[164] Piskulich, 2001.

[165] Byers, 2000.

[166] ITTO, 2002.

eration rather than other land uses or for changes in major funding initiatives such as those under the European Common Agricultural Policy. More generally, major changes are still needed in global trade policy to remove the perverse incentives that currently act against restoration in many areas.

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18
Negotiations and Conflict Management

Scott Jones and Nigel Dudley

Key Points to Retain

Forest landscape restoration relies on achieving broad consensus among a variety of stakeholders.

However, stakeholders may have very different perceptions of what forest landscapes should provide.

This will require a certain amount of negotiation and possible conflict resolution.

1. Background and Explanation of the Issue

Forest landscape restoration approaches use the restoration of forest functions as an entry point to identify and build a diversity of social, ecological, and economic benefits at a landscape scale. As such they rely on achieving broad consensus on a range of restoration interventions from a variety of stakeholders, who may have very different perceptions of what forest landscapes should provide. This requires effective negotiation among stakeholders whose negotiation skills, interests, needs, and power are often markedly different. However, the success of forest landscape restoration approaches often hinges on how successfully such negotiations are conducted. The principles of forest landscape restoration, therefore, aim at restoring forests to provide multiple social and environmental benefits through processes that involve stakeholder participation. The achievement of these ambitious goals relies on finding a successful passage through an array of practical challenges. These include the implications of current and future land tenure, competing land uses, and reaching a balance between different management regimes. Success depends on the ability of those initiating or guiding a forest landscape restoration project to manage the tensions and conflicts that will arise on the way. This, in turn, implies a certain amount of knowledge about how to identify, analyse, and manage conflict, retaining the varied, useful perspectives that are helpfully expressed through conflict, while resolving or mitigating those aspects of conflict that are dangerous or prevent project success.

1.1. Types of Conflict

There are two aspects that characterise conflicts: their openness and the type of conflict.

Conflict can be concealed or open[167]; either can cause problems in developing successful landscape-scale approaches to restoration:

- Open conflicts: everyone can see them and knows about them.
- Hidden conflicts: some people can see them and know about them, but hide them from others (particularly outsiders), perhaps because of cultural or social reasons (e.g.,

[167] DFID, 2002a; Fisher et al, 2000.

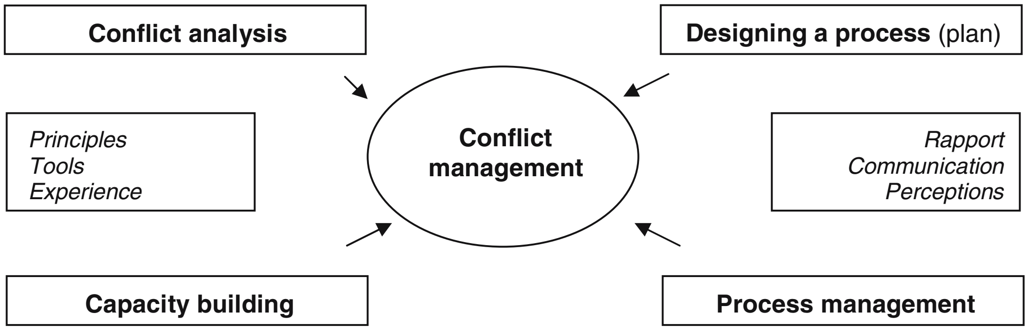

FIGURE 18.1. Building blocks in the conflict management process: elements in a conflict situation.

many gender-related conflicts) or because disputes may be embarrassing to the community (e.g., disagreements between young people and elders).

- Latent conflicts: these come to the surface when something changes the status quo. For example, if a restoration project brings benefits (money, power, influence, equipment), their distribution can create conflicts that were not there before the project arrived.

There are also different types of conflict. It is important to understand which type of conflict one is facing since each needs addressing in a different way.

- Interpersonal conflicts: between two or more people relating to personality differences
- Conflicts of interest: someone wants something that another has (e.g., money, power, land, influence, inheritance)
- Conflicts about process: how different people, groups, and organisations solve problems (e.g., legal, customary, institutional)
- Structural conflicts: the most deep-seated type relating to major differences that are hard to address (e.g., unequal social structures, unfair legal systems, economic power biased toward certain stakeholders, or differences in deep-seated values, such as cultural or religious)

Sometimes one type of conflict, perhaps unthinkingly, is disguised as another, for instance a personality clash may be presented as an issue of process.

1.2. Elements in a Conflict Situation

Managing conflict is not a straightforward process. Rather, there are a number of key building blocks in a conflict management process that interrelate and must often be undertaken in parallel (Figure 18.1[168]):

- Conflict analysis is about understanding who the different stakeholders are, what are their strengths, fears, needs, and interests, and how they perceive or understand the conflict(s).
- Capacity-building is about helping people to manage conflict. It may be required at any time. For example, it may take place prior to negotiations because some stakeholders need to develop negotiation skills. It may take place before agreements are signed because different groups like to have agreements in different forms; it is important that all groups have the capacity to understand each other's approaches to problem solving and reaching agreements. Capacity-building often takes the form of training (e.g., in negotiations or "people" skills), but sometimes other resources are needed.
- Designing a process is about planning who to bring together, where, when, and how. The most effective conflict management processes are usually flexible, iterative, and capable of keeping stakeholders on board as events, issues, and even the attitudes of the conflicting parties change.

[168] Modified from Warner and Jones, 1998.

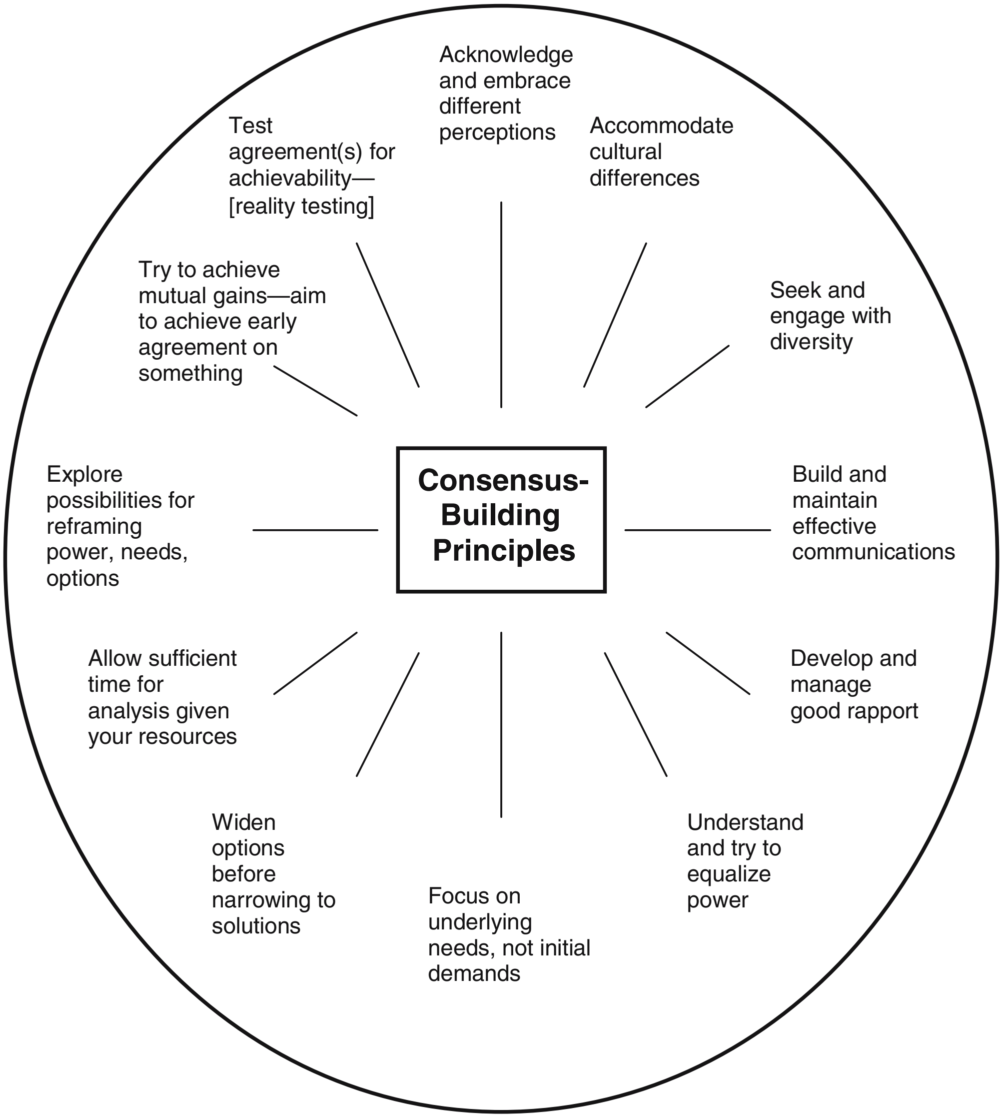

FIGURE 18.2. Principles for successful negotiation.[168a]

- Process management is about how to build and maintain effective ways of working with the parties, to retain flexibility and patience, while still keeping focussed on outcomes and working toward success on the criteria that stakeholders have agreed to, for example, how to convene an effective meeting with clear goals, or how to monitor an agreement.

Achieving these things requires adhering to certain *principles* (e.g., mutual respect, being accountable, recognising the potential and limits of your influence, see Figure 18.2), using certain *tools* (e.g., stakeholder and gender analysis), and applying key *experience* (e.g., with similar projects or with these people in other projects). They also require key people *skills*, among the most important of which are maintaining good *rapport* and effective *communications*, and effectively engaging with the multiple *perspectives*.[169]

[168a] Modified from Warner, 2001.
[169] Jones, 1998.

Box 18.1. Examples of Best Alternative to a Negotiated Agreement (BATNA) in the Context of Forest Landscape Restoration

The loggers simply don't want to negotiate at all. They are going to go ahead and cut those trees.

BATNA—What about going to the newspapers? Let the media know that this biodiversity hotspot is threatened and local people are suffering.

The donor is not able to give you another grant to add an extra component to this work.

BATNA—Perhaps write a report that helps to bring the donor's expectations in line with your capacity to deliver.

The people in the community feel powerless to enter face-to-face negotiations with the government and the large Geneva-based and Washington, DC–based agencies.

BATNA—Possibly see if a mediator can be found who would be acceptable to both sides.

The negotiations went well and trust is high, but the government was unable to agree involvement of their officials due to government rules.

BATNA—Perhaps work with another NGO with relevant expertise that can complement you but has no government restrictions over committing official staff.

1.3. BATNA (Best Alternative to a Negotiated Agreement)[169a]

Negotiations are a voluntary process. But what if the other person is completely inflexible, breaks the ground rules you agreed to, and only wants his or her own way. In short, what if the other person does not want to negotiate? Similarly, what if the other person is negotiating in good faith, you have excellent communications, and trust each other, but it is simply not possible (in his or her view) to meet even your "bottom line" needs? Under these circumstances, you need an alternative to negotiation. There may be several alternatives. What you really need is the best one.

So what would be your best alternative to a negotiated agreement? In the (unfortunate) language of conflict management, this has become known as a BATNA (best alternative to a negotiated agreement). Box 18.1 illustrates some examples of where a BATNA may be appropriate.

[169a] Fisher and Ertel, 1995.

1.4. Project and Process Management

Any approach to forest landscape restoration requires time and resources to identify, to agree to, and to manage the process. Different agencies have different approaches to project and process management, developed perhaps from commercial approaches or international development models. Clearly, in the world of logical frameworks, multi-stakeholder partnerships, and collaborative management schemes, the management process itself is a subject for negotiation that requires the full range of skills and principles discussed above.

Conflicts over one form of management indicate an opportunity to search for other approaches that can helpfully deal with the legal, financial, political, and operational issues that any complex project or programme involves. It follows that successful forest landscape design will be able to identify and engage with different management approaches and use the negotiation process to build ownership while deciding roles and responsibilities. Sometimes one agency or another will desperately seek management control, and the task is to negotiate shared understandings and responsibilities. At other times, it is a hard task to identify any agency that feels able to take management responsibility. Again, this is an opportunity to explore why, and to undertake a collective search for a solution that supports stakeholders who are willing to put their names forward.

1.5. Negotiation Health Warning

Finally, it is important to note that like other aspects of conflict management, negotiation is a culturally bound process. Different societies, groups, agencies, and organisations all have different cultures and approaches to managing conflict. While much of the literature on negotiations is Western and business-oriented, there needs to be a high degree of cultural sensitivity and contextually located understanding to proceed with negotiations, especially where many different cultures are involved in multi-stakeholder negotiations.

2. Examples

There is very limited experience in applying conflict resolution and negotiation skills to landscape initiatives in forest restoration. We highlight here just a few examples from other chapters in this book that have shown some successful or interesting outcomes through negotiations.

- In Vietnam, a three-dimensional paper and cardboard model was used to bring stakeholders together around "their" landscape to identify specific elements within it. The process was aimed at reconciling different views of the landscape and what it could look like in the future. It provided those around the model with the opportunity to express their views on the importance of different elements in the landscape (more information on this example can be found in "Assessing and Addressing Threats in Restoration Programmes").
- In Malaysia, an ongoing negotiation process with oil palm plantation companies is gradually ensuring a change in the companies' policies related to restoration. Whereas initially the companies converted their entire estates to oil palm, they are now gradually allocating part of their land for natural regeneration and plantation of local species (for more on this example see "Restoring Quality in Existing Native Forest Landscapes").
- In Jordan, negotiation between goat herders and park authorities ensured a reduction in grazing, thus allowing for more natural regeneration (for more on this example see "Restoration of Protected Area Values").

3. Outline of Tools

Learning and applying the tools and skills for successful conflict management cannot come from reading books or attending courses alone, but also involves long periods of trial and error, and observation—"learning by doing." Many participatory techniques described elsewhere in this book are relevant. Tools and skill sets for conflict management that are particularly relevant include those relating to analysis, capacity building, communications, creative thinking, negotiation, and project and process management.

3.1. Negotiation Process

Negotiating involves meeting to discuss ways of reaching a mutual agreement or arrangement. A negotiation is a voluntary process in which each person or group (often called a party) has a position that is not fixed, but that does have its limits. A successful negotiation can create a sense of ownership and commitment to shared solutions and shared follow-up actions. This sense of ownership and commitment makes negotiated solutions often more desirable, for example, than legal solutions, where one party may feel it lost out. In a conflict, some things cannot be negotiated, and some things can. Usually it turns out that many more things can be negotiated than people first thought. This is another reason why negotiated agreements are a valuable way, though not the only way, of trying to manage conflicts in forest landscape restoration. It follows that a first step in negotiation is reaching agreement on what is negotiable. Successful negotiations follow certain important principles (see Box 18.2) and require

Box 18.2. Some Principles and Skills Involved in Negotiating Forest Landscape Restoration (See also Figure 18.2)

Be clear on what everyone means by the issue and the problems, opportunities, and people/agencies involved

Adopt a positive attitude, for example, being clear that conflicts are not just problems but also opportunities

Have in mind some kind of a route map, some idea about ways in which key stakeholders wish to proceed

Address role, responsibility, and legitimacy issues, including the limitations (boundaries) to your negotiating authority

Build and maintain effective rapport and relationships

Active listening

Identify high-quality, relevant questions

Embrace multiple perspectives and perceptions

Build on what is already there (including cultural aspects of conflict management and problem solving)

Consider process (law, custom, institutional) as well as structural conflicts and conflicts of interest

Keep in mind options for withdrawing or not getting involved further

Keep an eye on capacity building for self-development and organisational development

Separate and focus on the problem and not the personalities

Separate and focus on underlying needs and motivations, not initial positions

Know what you would do if the negotiations did not work, perhaps because the other party broke the ground rules or tried to use unacceptable force (this is also called knowing your BATNA: best alternative to a negotiated agreement; see Box 18.1)

Seek, explore, and emphasise common ground

Put your case in terms of their needs, not just why *you* want something

The more you know about the other's position, the better able you are to find consensus-based solutions; do some homework to find out their situation

Maintain a creative, positive approach

Use paraphrasing and other communication skills to understand and describe the other's points

Create a positive environment for the negotiation (think about the physical setting, the comfort and acceptability of the place, the time, and the way you manage yourself)

Look for an early, small successes (reach agreement on something early, even if that is just the venue, then emphasise that agreement; common ground—start small)

Make sure your preparations are as complete and accurate as possible. Write down what you have done to prepare. Check with a colleague. Check with another colleague. Seek constructive feedback.

Keep in mind:

1. The process and conflict management style
2. Your goals and boundaries (your limit or bottom line)
3. Opportunities to address power inequalities
4. Your colleagues' needs, expectations, and ability to act as resources
5. Your personal values and principles
6. Time and space for reframing issues
7. Capacity building needs that may emerge
8. The needs for more analysis that may emerge

Multiple perspectives and perceptions can be useful. A diversity of opinion helps us shed light on the issue from different directions. Treat difference and diversity not as an emotional trigger to fight against, but as a moment of opportunity to engage with.

knowledge, skills, and a *positive attitude*. It is helpful to look at each of these things in relation to three phases in negotiations:

- Preparation—what we need to do before the negotiation
- Negotiation itself—could take place in one meeting or over several meetings
- Follow-up—what we need to do after the negotiation is over and agreement has been reached

A negotiation can happen at any time. Entering a community or a government official's office may require a negotiation. The gatekeeper may want to know some details before people just walk in, including when a group or agency will arrive, how long it will stay, under whose authority, with what level of formality, and to do what.

Having agreed to who are the stakeholders who need to be involved, a process of negotiations in forest landscape restoration will probably look something like this:

1. Each group works to understand the other group's initial positions relating to the landscape.
2. Each group then asks high-quality questions and uses listening skills to try to understand underlying needs, fears, and motivations in identifying restoration interventions.
3. The parties try to deploy creative thinking and other skills to generate a wide range of options that could address these needs, fears, and motivations.
4. This range of options is prioritised and brought together in ways that allow everyone to gain as much as possible.
5. An agreement is sought, to which everyone can commit.
6. That agreement is tested against the real world to make sure it is achievable.
7. The parties agree on the next steps, on how to manage the restoration interventions and the resources that are needed, and on ways of monitoring the agreements and commitments they have made.

3.2. Analytical Tools

A large number of analytical tools and skills that are used in participatory forest management, project management, and development can be brought to bear in conflict management. Examples include *participatory appraisal*,[170] a variety of approaches for measuring and *analysing sustainability*,[171] and more general tools that help to frame and guide further analysis, such as *STEEP, SWOT, problem trees, and forcefield analyses*.[172] The key is to use those that are relevant for different stakeholders and that help to bring understanding and wider perspectives on the issues. Key analytical tools, though, include the following:

- Stakeholder analysis[173]
- Conflict mapping and situation analysis[174]
- Tools that address power relations, culture, and gender[175]

A variety of analytical tools can feed into a summary conflict analysis. Conflict analysis can be done in the office (alone or in a group) or in the field (for example, in participatory exercises) or in combination. Successful analyses are clear about who undertook the analysis, when, and why, and make it clear how different groups were involved in verifying and agreeing to analysis summaries from different stakeholder perspectives. Of course, as events change and time moves on, analyses need to be revisited. This is especially important when new stakeholders enter the picture or established stakeholders leave, and when critical events change key stakeholders' circumstances.

Analysis helps to identify the domain of conflict (e.g., domestic, social, cultural, economic, or political) and whether conflict is nested within several domains. Conflict mapping with key individuals or stakeholder groups, can help to summarise information and show up major differences and possible ways forward. One example is given as a matrix (Fig. 18.3). However, flow charts, Venn diagrams, and other visually powerful mapping tools can help

170 Jackson and Ingles, 1998; www.fao.org/participation.
171 Bell and Morse, 2003; Dalal-Clayton and Bass, 2002.
172 Pretty et al, 1995.
173 DFID, 2002b, section 2; Ramirez, 1999; Richards et al, 2003.
174 DFID, 2002b, section 3; Fisher et al, 2000; Wehr, 1998.
175 Fisher et al, 2000.

Name of person or party	A	B	C
Position or stance in relation to the conflict			
Needs			
Concerns, anxieties, or fears			
Attitudes toward the others			
Assumptions about the others			
Values and beliefs			
Historical issues (e.g., past misunderstandings)			
Types of power (e.g., moral, financial, political)			

FIGURE 18.3. Matrix to help analyse conflict.

communicate the outcomes from an analysis. It is important to remember, though, that the process of analysis itself is a part of managing conflict. Done well, the process itself can help foster trust and mutual understanding. An early agreement on the individual and collective concerns and opportunities can help establish the stage for positive negotiation of emerging issues.

3.3. Capacity Building

Undertaking a process of analysis often requires capacity building. Some stakeholders will be familiar with negotiating from a business perspective. Others will see negotiations as embedded within their own culture and society—the way they negotiate and problem solve will be different. Others may use legal frameworks or a scientific approach to analysis. Again, addressing the process of analysis is itself a part of the overall approach to managing conflict. Capacity building skills and tools may need to be deployed at an early stage.

Identifying and responding to gaps in conflict management skills or to gaps in resources requires a sophisticated approach to capacity building backed up by appropriate levels of resourcing (e.g., for training and stakeholder support). Building capacity is best seen as an ongoing activity rather than a linear one. High-quality capacity building forms part of addressing inequalities in power relations. Strengths and needs analysis and some form of training needs analysis are important first steps in capacity building.[176] Capacity building actions also need to be linked with reflection, so that interventions can be monitored and evaluated on an ongoing basis. This process, too, helps to build confidence and trust, when people appreciate the fact that someone somewhere is taking responsibility for empowering key stakeholders to participate effectively.

3.4. Effective Communications

Building and maintaining effective communications are key aspects of conflict management and multi-stakeholder partnerships in forest landscape restoration. Providing, managing, using, and facilitating access to information is part of any communication strategy.[177] What is additionally important in conflict management is ensuring that these things translate into meaningful understanding. Indeed, effective communications are vital to generating and disseminating the high levels of understanding of different stakeholders' perspectives and needs that good conflict management requires. Some aspects of effective communications relate to general communications strategies: the frameworks and mechanisms for enabling stakeholders to engage with one another on relevant matters. This includes documents, meetings, the use of different media, and an overall information, communication, and monitoring management system, such as a logical framework or

176 Bartram and Gibson, 1997.
177 Dalal-Clayton and Bass, 2002, Ch. 8.

Box 18.3. Barriers to Good Listening

"On-off listening"—drifting off into personal affairs while someone is talking

"Switch off" listening—words that irritate us so that we stop listening

"Open ears–closed mind" listening—we decide the speaker is boring and think that we can predict what he or she will say, so we stop listening

"Glassy eyed" listening

"Too deep for me" listening—when ideas are complex or complicated there is a danger we will switch off

"Matter over mind" listening—when a speaker says something that clashes with what we think and believe strongly, we may stop listening

Being "subject-centred" instead of "speaker-centred"—details and facts about an incident become more important than what people are saying themselves

"Fact" listening—we try to remember facts but the speaker has gone on to new facts and we become lost

"Pencil" listening—trying to put down on paper everything the speaker says usually means we are bound to lose some of it and eye contact is also lost

"Hubbub" listening—there are many distractions that we listen to instead

"I've got something to contribute" listening—something the speaker says triggers something in our own mind and we are so eager to contribute that we stop listening

An awareness of the above barriers to listening can be a first step in avoiding them.

Adapted from training materials, Centre for International Development and Training, University of Wolverhampton, UK.

action plan. Other aspects relate more to interpersonal communications, such as getting the balance right between telling and asking, or become a good listener (Box 18.3).

In dealing with conflict, one important distinction is between *telling* and *asking*. Giving free information is an important part of building communications. However, if one is usually "telling" people, this can be perceived as aggressive and dominating (e.g., "I'm going to tell you what the law says—and that is the end of the story"). Asking relevant questions in an involving, open way can communicate a sense of concern and interest, that someone has bothered to identify questions that may help mutual understanding. Of course, a balance between the two is needed.

3.5. Creative Thinking

People and agencies tend to think and react in the ways that they always have done. The way we think is constrained by many things, including our experience, worldview, education, and degree of comfort with new ideas. Creative thinking is about breaking these patterns to look at situations in new ways—thinking "outside the box." Creative thinking is an important asset to conflict management at all stages, not just analysis. Often, a breakthrough can come when creative thinking allows the situation to be reframed—changing the way we construct and represent the conflict.[178] Reaching agreement requires strong skills in synthesis—thinking creatively about how to develop an agreement and monitoring process that everyone can live with can be challenging. A number of tools exist that can help enhance people's creative thinking skills. One-on-one and in small groups, good facilitators and trainers can help to build creative thinking skills. Where things get trickier is moving through organisations' management and decision-making structures to translate the creative, useful thoughts into actions that are helpful. Creative thinking is culturally embedded. Indeed, culture plays a major part in resisting

178 Lewicki et al, 2003.

and improving creative thinking skills, in organisations as well as other groups.[179]

4. Future Needs

Most conservation organisations, forestry departments, and companies have only very limited knowledge about conflict resolution. Capacity building for conflict management and negotiation within conservation and forestry organisations is a critical need in terms of building the ability to work across broad scales and mainstream conservation. Most of the tools and expertise are known but have been applied in only a very limited way within the field of natural resource management.

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19
Practical Interventions that Will Support Restoration in Broad-Scale Conservation Based on WWF Experiences

Stephanie Mansourian

Key Points to Retain

Urgent conservation or livelihood problems may necessitate short-term, strategic interventions even in the absence of a longer-term programme.

A series of 10 different tactical interventions are suggested, ranging from threat removal to positive economic incentives.

1. Background and Explanation of the Issue

In the face of increased threat of massive species' extinction, with estimates that more than half of the world's threatened species live on less than 1.4 percent of the earth,[180] it may be important to consider a range of practical and tactical interventions to begin to reverse this rapid degradation, particularly in highly threatened areas that are extremely rich in biodiversity.

There are still surprisingly few examples of successful forest restoration from a conservation perspective, particularly at a large scale.[181] Elsewhere, we have discussed the importance of carrying out restoration as a component of larger conservation and development programmes, but in some cases there may also be opportunities to carry out useful restoration more opportunistically. This chapter is intended to highlight some tactical interventions that could be undertaken if framed within a forest landscape restoration process or approach.

Planning at a landscape or ecoregional scale is difficult enough, but actually intervening at that scale is generally harder still. In a forest landscape restoration context, activities such as planning, engagement, priority setting, negotiation, trade-offs, modelling, etc. are usually all best carried out at a landscape scale. However, with the exception of some policy interventions, most of the *practical* restoration actions will take place at sites within the landscape or ecoregion. Although planning processes are often lengthy, some actions can often start in anticipation of the overall long-term strategy to restore forest landscapes; generally some responses will be clear and uncontroversial and these can often be initiated even whilst more difficult issues remain unresolved.

This chapter discusses the types of specific and punctual interventions related to restoration that a field programme may consider undertaking. Some of these would be expected to arise within a longer term strategy to restore ecological and social forest functions but may also come in advance of such a strategy due to lack of funds for the overall process, lack of buy-in from stakeholders, and other issues relating to expediency or urgency. When a species is facing immediate threats of extinc-

180 Brooks et al, 2002.
181 TNC, 2002.

tion, for instance, short-term measures may be needed even while long-term planning is still in process. None of the proposed interventions below replace larger scale efforts, nor are they meant to be implemented in isolation from a broad-scale planning process. Rather, they are to be seen as elements of the larger process and as possible entry points; success at a small scale is one of the most effective ways of gaining support for larger-scale programmes.

When selecting one of the proposed entry points listed below (see Outline of Tools), it is important to think of the desired impact of this tactical intervention:

- Is it to influence a specific group of stakeholders? Which one and what is the desired effect?
- Is it to understand better the dynamics (biological or social) in the landscape?
- Is it to change sociopolitical conditions in the landscape before engaging in restoration within the landscape? Which conditions? And what is the most cost-effective way to change them?
- What are the resources (human and financial) and time involved? Can we afford them?
- What are the priority issues that need addressing soonest?

2. Examples

2.1. Research into Different Restoration Methods in Malaysia

Some palm oil companies along the Kinabatangan River in Sabah, Borneo, have agreed to set aside land for restoration. Initial trials showed limited success. Starting in 2004, in an effort to identify the most successful techniques for restoration, tests began using different methods on a small plot of land. These are the methods proposed (during a field visit by the author):

- Natural regeneration with no intervention (including a smaller study area fenced against browsing animals)
- Assisted natural regeneration (mainly some land preparation and weeding around regenerating species)
- Planting with native species (using species adapted to local conditions and including if possible both commercially valuable dipterocarp trees and fruit trees)
- Planting an exotic species as a nurse crop to foster natural regeneration

Each approach is to be monitored on a regular basis in order to determine which one yields the highest survival rates. The long-term aim of this research is to disseminate the most suitable restoration methods in all the areas set aside for restoration along this important biodiversity corridor.

2.2. Changing the Forest Policy in Bulgaria Thanks to a Cost-Benefit Analysis[182]

Bulgaria's 75 islands on the Danube river are rich in biodiversity, and are an important stopover site for migratory birds. Yet, over the last 40 years, the government has systematically converted natural floodplain forest to hybrid poplar plantations to supply the local timber industry. Until the year 2000, the government had plans to continue conversion of this ecosystem, leaving only 7 percent of the original forest. Thanks to a comprehensive cost-benefit analysis, sponsored by the World Bank and WWF, it was shown that financial losses from suspending timber production on certain islands could be offset by intensifying production in areas already converted to poplar plantations. Additional benefits that were highlighted by the analysis included the potential use of original forest for recreational purposes, improved fishing (by creating more spawning grounds), the harvest of nontimber forest products, and possible ecotourism development. In 2001 the government, therefore, changed its policy, adopting one that called for the immediate halt of all logging and conversion of floodplain forests to poplar plantations on the Danube islands, restoration of native species

[182] Ecott, 2002.

in selected sites, as well as strengthening of the protected areas network on the islands. Although a longer term forest landscape restoration programme for the Danube is underway, this tactical intervention helped to maintain a unique habitat that might well have disappeared before the more detailed programme was implemented.

3. Outline of Tools

3.1. Focussing on Removing or Reducing the Identified Threats

Sometimes it will be sufficient to remove, reduce, or mitigate a particular threat or pressure on forests in a landscape to set them on a positive path toward regeneration. Because threats often originate from political or economic decisions, changing them may require significant lobbying, backed up by negotiations, research, and building of strategic partnerships. If these threats can be reduced or removed, natural regeneration can often be significant (if there are no other biophysical constraining factors).

Examples of threats that are common as an impediment to natural forest regeneration include the following:

- Alien invasive species (e.g., electric ants, *Wasmannia auropunctata*, in New Caledonia)
- Government incentives that foster forest conversion (e.g., Chile's subsidies for plantations)
- Infrastructure projects (e.g., the construction of the Ho Chi Minh highway in Vietnam)
- Demand for cash crops (e.g., valuable soya expansion in Paraguay causing forest conversion)
- Unsustainable agricultural practices (e.g., Slash and burn agriculture in Madagascar)
- Illegal logging (e.g., in Indonesia)
- Uncontrolled and "unnatural" fires (e.g., in India)

Concentrating first on removal of threats is appropriate when it is clear that addressing the identified threat can lead to natural regeneration or restoration with only limited interventions. This is also a necessary choice in cases when a field project cannot start until the threat has been addressed.

Depending on the social and economic context, some threats may be much easier to address than others. For instance, illegal logging is in itself a very complex issue, which may well be beyond the remit of a restoration project. However, knowledge of key areas affected can help determine where (or even whether) and how to establish a restoration programme. It is important to recognise threats that cannot be addressed, or resources may be pumped into a hopeless situation.

3.2. Changing Government Policies

Often, a change in government policy may provide the right conditions to promote restoration (also see "Policy Interventions for Forest Landscape Restoration"). In some cases it may be necessary to lobby for more supportive policies, while in others, it may be necessary to remove destructive ones. The European Union's (EU's) Common Agriculture Policy (CAP) has for instance invested significantly in afforestation with limited social and ecological results (see case study "The European Union's afforestation Policies and their Real Impact on Forest Restoration"). WWF and other local partners are trying to address this in many EU countries (particularly in southern Europe) by demonstrating alternative, more socially and environmentally appropriate forms of restoration that could be financed by the same CAP subsidies. It will be important and relevant to focus efforts on government policies when these have been identified as a key factor in causing the loss and degradation of forests (e.g., perverse incentives) or when there is a clear opportunity to engage the government in supportive policies (e.g., a new forest plan being developed). In some countries, like Vietnam or China, there are huge government programmes promoting investments in reforestation/afforestation. Because of the scale of these programmes, it is often wiser (and economically more efficient) to engage in these processes than to invest efforts in a separate project.

3.3. Using Advocacy Levers

Some advocacy, lobbying, and economic tools can be used to encourage change that supports forest restoration or that removes or reduces the pressure on forests.

- Market pressure: The market may be used to promote the use of products from well-managed forests or forests that are being restored. For example, WWF has worked on the palm oil markets in Switzerland to promote better practices in Malaysia where the oil palm plantations have significantly damaged natural forest cover and where restoration of natural forest is now having to take place. This signifies engaging in research on market routes and raising awareness at the consumer end, as well as promoting solutions for better practices at the production end.
- Pressure using multilateral donors: Multilateral donors may be used as a lever for change either through their own projects or through imposing conditionality on loans. For example, agencies such as the Asian Development Bank (ADB) have active projects related to forest policy, but they also finance plantation projects. In Vietnam, for instance, the ADB is one of the main donors to the government's Five Million Hectares Reforestation Programme. Working together with such institutions may be a way of improving practices within their projects and also encouraging change in those projects that they finance.
- Communications/media tools such as Gifts to the Earth: WWF developed the Gifts to the Earth tool, a public relations mechanism, to pay tribute to major acts that favour the environment. This is one of many creative tools that may be used as an incentive for a government or other decision maker to change current policies or adopt new ones that would be more beneficial to or supportive of restoration.
- Campaigning: mobilising many stakeholders to put pressure on the relevant decision makers (governments, multilateral agencies, the private sector) is an effective means of ensuring change. It does need to be used carefully, however, and must be founded on good data.

3.4. Changing Companies' Practices

Traditionally, conservation organisations have not worked much with the private sector. Yet given that the largest companies are larger financial players than most governments and that they often determine future land-use options (e.g., mining companies, plantation companies, infrastructure companies), it is important to work with them in any large-scale restoration effort in order to ensure that restoration is well integrated in their plans.

This is, for instance, an effective way of encouraging companies to adopt best (or at least "better") practices. Many companies are happy to work with civil society organisations especially if improvement in their standards means some form of certification, media opportunities, and even in some cases the additional bonus of more efficient (cheaper) production. The sorts of sectors that may be influential include the infrastructure sector, the mining sector, and the forestry sector. WWF is currently engaging with large plantation companies such as Stora Enso to not only promote better management of their estates but also assist them to restore areas of the land that they manage.

3.5. Valuing Forests

Governments sometimes neglect or mismanage forests because the goods and services that they produce have not been properly valued. By obtaining recognition of the value of forests from either the government (if it is the major cause of concern) or local communities, restoration of those values can be promoted.

This can be done a number of ways:

- Through a traditional cost-benefit analysis that would provide a good argument for restoration for governments (see the Bulgaria example, above)
- Through research and surveys with local communities, particularly elders, to identify what values have been lost and what values

they would like to see restored. For example, in Vietnam WWF has engaged with communities and the provincial government in the central Annamites to identify the forest values that have been lost as a starting point for setting future restoration objectives.

While recognising the value of forests is one important step, it is but the first step. Governments and other decision makers then need to take necessary measures to ensure that those values are protected and where relevant restored.[183]

3.6. Specific Research

Often a large-scale programme to restore a range of forest functions cannot start until a number of specifications of the landscape are better understood. Initial research can be carried out with limited funds as a way to start a larger-scale programme.

This research may be related to any of the following, for example:

- Restoration techniques: While a number of restoration techniques have been tried and tested, it is not always easy to know which one will work best under local conditions. A small-scale trial plot can help identify those (see example on Borneo, above).
- Species' mix: Often exotic species have been used because they are better understood than local ones. Research money may be well spent on identifying the growth rate of and necessary conditions for specific local species as well as on the optimal mix of species.
- Removal of invasive species: Invasive species can often be the single most important impediment to natural regeneration or maintenance of forest quality within existing forests. Applied research can help test different techniques to remove the invasive species while promoting indigenous ones.
- Communities and stakeholders: Socioeconomic research may be necessary to understand better the profiles of stakeholders in the landscape and their motivations, pressures, livelihood conditions, and aspirations.
- Market research: Market research may be helpful when seeking to promote alternative income generating activities.
- Upstream versus downstream: In a landscape context, it may be important to identify the types of activities upstream and their impact downstream. For example, deforestation upstream may be causing sedimentation problems downstream. To encourage restoration within the landscape context, such cause and effect will need to be clearly demonstrated to stakeholders and substantiated by suitable research.

The above represent but a few of the numerous research topics. There are many others that are specific to different conditions.

3.7. Awareness Raising

If there is no identified need from the local population for restoration, then attempts at restoration are likely to fail. It is important to ensure that relevant stakeholders understand the linkages between restoration and the things that matter to them (availability of useful plants, soil protection, provision of forest products, etc.), and this may necessitate an awareness-raising campaign. For example, in New Caledonia, WWF is one of nine partners engaging in the protection and restoration of the dry forest. The project has a number of components, including active engagement of stakeholders (particularly land owners), and it has spent considerable time and resources working with local landowners to mobilise their support for restoration and to help them understand the implications of restoring the dry forest (benefits and costs).

There are a number of different forms of publicity (different media, workshops) and part of the skill in successful advocacy is in identifying the one that will reach the target audience (e.g., radio is often a good way of reaching rural populations in poorer countries).

3.8. Training and Capacity Building

One tactical intervention may consist of offering training in relevant restoration techniques. For instance in Morocco, WWF has been

[183] Sheng, 1993.

invited to help redesign the university's forestry curriculum to include specific restoration elements.

The sorts of training that can be provided include the following:

- Nursery design and development: Training can be provided to farmers and other community members on managing tree nurseries. This may also include elements of seed recognition and collection.
- Agroforestry techniques: When agricultural practices are an issue, training farmers in techniques such as agroforestry that are more compatible with some form of natural forest cover can be a useful approach within a forest landscape restoration initiative.
- Training can be provided in alternative income-generating activities (see below) to reduce the impact people are having on forests while offering them a realistic livelihood alternative.
- Improved grazing practices may sometimes be a simple way of returning areas of land to natural forest.
- In relevant cases, training may involve better fire management practices (to remove fire risks, to control them, or to undertake prescribed burns).

3.9. Forest-Friendly Economic Activities (Microenterprise Development)

In many countries the pressure on forests, the conversion of forests, or the hindering of natural regeneration is driven by the poorest people, who rely on forests for their immediate needs but are under too much short-term pressure to invest in long-term restoration strategies. One way of addressing this may be by providing training in improved practices that will help both sustain their own resource base and reduce forest degradation, or, on the other hand, by offering new economic activities that reduce their detrimental impact on forests. For a conservation organisation, this will generally require partnering with development organisations with expertise in, for example, microenterprise development.

For example, in Madagascar, the main threat to forests is slash-and-burn agriculture with short fallow periods. In a country with such high poverty levels, the only way to reduce this pressure on forests is to provide alternative livelihood options for those local communities. A number of successful microenterprise development programmes have been attempted by entities such as USAID (US Agency for International Development),[184] the U.N., and CARE. These programmes may not have been explicitly intended to reduce pressure on forests, but in partnering with conservation organisations two objectives could be reached: improving livelihoods while ensuring that forests are protected and, where appropriate, restored. When promoting such alternative livelihood options, it is important to undertake suitable feasibility and market studies, and not engage people, for instance, in honey production if there is no market for it.

3.10. Paying Communities for Better Practices

It may sometimes be necessary or appropriate to use project money to compensate communities for the loss they suffer by accepting restoration on land they own or use. This could be a first activity before developing alternative livelihood options. It can also be a way of engaging communities that may not otherwise be very receptive to the project. One risk with this approach is that of getting communities accustomed to compensation and expecting it over the long term. This clearly needs to be a short-term activity with a clear plan to move into other activities.

4. Future Needs

In an ideal world, a comprehensive restoration programme would be well thought out, would address a range of stakeholders' priorities, would be implemented at various scales (national, local, regional), and would be given the necessary resources and time to succeed.

[184] ARD-RAISE Consortium, 2002.

Unfortunately, this is often not the case, and therefore punctual interventions like those listed above may become necessary first actions. All of the actions listed above would benefit from being integrated into large programmes that aim to restore forest functions within landscapes for the benefit of people and biodiversity. One future need, therefore, is for decision makers and donors to allocate sufficient resources to allow for the implementation of the large-scale programmes that are required to achieve the restoration of forest functions in many regions of the world. Another need is for more creative partnerships between public, private, and civil society organisations, as well as between development and conservation organisations to achieve the ambitious aims of restoring forest functions in landscapes.

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Section VII
Monitoring and Evaluation

Appendix 1
Selection of Identified Ecological Research Needs Relating to Forest Restoration

1. Long-Term Impacts of Restoration on Forest Ecosystems

- Understanding of the long-term dynamics of different ecosystems to help develop realistic restoration targets
- Understanding the ability of different forest ecosystems to recover quality over time and particularly about the likely speed of recovery and the length of time after degradation when a forest can still recover (linked, for instance, to survival time of buried seed populations), all of which are critical for determining whether natural regeneration will suffice or more active efforts are required
- Measuring the sustainability of different restoration efforts, from ecological, social, and economic viewpoints
- Identifying the opportunities for manipulating natural succession to favour desired outcomes
- Understanding what could enhance natural succession after land abandonment

2. Climate Change and Adaptation

- Implementation of field projects to test and if appropriate develop restoration's role in mitigating as well as in building resilience to climate change
- Creative partnerships to analyse climate impacts and proposed restoration activities

3. Knowledge of Species

- Understanding the role that individual species and microhabitats have in the restoration of ecosystem processes
- Clarifying the potential of indigenous species in restoration where planting is necessary, including information on genetics, propagation techniques, the dynamics of ecological succession, the relationships between different species, the performance of indigenous species in plantation conditions, and the production of specific species in nurseries
- Disseminating information on where to obtain seed of indigenous species, how to store the seeds, how to raise seedlings, and how to establish these seedlings in the field

4. Plantations

- Developing user-friendly and location-specific silvicultural guidelines for plantations with indigenous species to increase their adoption by local farmers
- Gathering more information on the long-term dynamics of tree regeneration in plantations (to date, most studies have focussed on young plantations)
- Enhancing understanding of the role and limitations of plantations in landscapes

5. Linkages and Connectivity

- Understanding the role of corridors and ecological stepping stones and in particular how to make these most effective, conditions in which they will and will not work, challenges, problems to avoid, information about distances species will disperse over unsuitable habitat, use of corridors by invasive or pest species
- Developing greater experience on issues related to connectivity of forests across landscapes; for example, connectivity can be at least obtained through the use of lines or even isolated trees in the landscape, serving to buffer plantation areas, changing the "shape" of the plantation, etc.

6. Fires

- Increasing understanding of natural fire regimes including the forest structure needed to avoid high-intensity destructive fires and the associated management implications
- Developing cost-effective fire control measures with minimal biodiversity impacts

7. Invasive Species

- Improving methods for the control of invasive species
- Developing a comprehensive solution for dealing with invasive alien species as part of forest restoration

8. Artificial and Natural Disturbance

- Drawing up codes of practice and perhaps principles for artificial disturbance
- Developing and disseminating methods of enriching degraded or regrowth forests
- Developing enrichment planting guidelines that are species- and site-specific

9. Water and Forests

- Developing tools and methodologies for calculating net gains of different restoration and management actions from the perspective of water supply
- Improving understanding of watershed-scale processes

10. Links Between Site Conditions and Species

- Clarifying species-site relationships—there is often surprisingly little knowledge of the distribution patterns and site requirements of most tropical tree species
- Quantifying better the influence of site conditions (precisely for each parameter) on species' development and growth and on communities' composition, and diversity, along with a better comprehension of the potential trajectories of the communities (i.e., rupture thresholds, lag of time response).

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