Managing ecosystems for multiple environmental services and biodiversity in the context of climate change

UNFCCC Workshop on technical and scientific aspects of ecosystems with high-carbon reservoirs not covered by other agenda items under the Convention
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1) Managing ecosystems to meet multiple demands – trade-offs and synergies

Ecosystem services

(MEA 2005)

1. **Provisioning services**: Goods or products obtained from ecosystems;
2. **Regulating services**: Contribution of ecosystems to control of natural processes, e.g. water cycle;
3. **Cultural services**: Immaterial benefits obtained from ecosystems;
4. **Supporting services**: Natural processes that facilitate the provision of other services, e.g. soil formation.

Biodiversity underpins all ecosystem services.

Trade-offs and synergies between different kinds of services

- Capacity for regulating and supporting services is often highest where levels of anthropogenic impact are low
- Trade-offs frequently occur among provisioning services, and between provisioning services and other service categories
- Conflicts between provisioning and regulating / supporting services are often best addressed by adjusting methods and intensities of use

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Important ecosystem services in the context of climate change

Contribution of ecosystems to climate change mitigation

- Carbon sequestration and storage in biomass and soils
- Note: this is a case where benefits of local management actions accrue at global level

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Important ecosystem services in the context of climate change

Contribution of ecosystems to climate change adaption

- Ecosystem services can reduce climate change impacts on people
- Adaptation actions may be needed to ensure continued provision of ecosystem services under climate change

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Examples

Ecosystem services can **reduce climate change impacts on people**

Recommended approaches against health risks from more frequent heat waves include enhancing green space in cities

Source: Mathey et al. 2012

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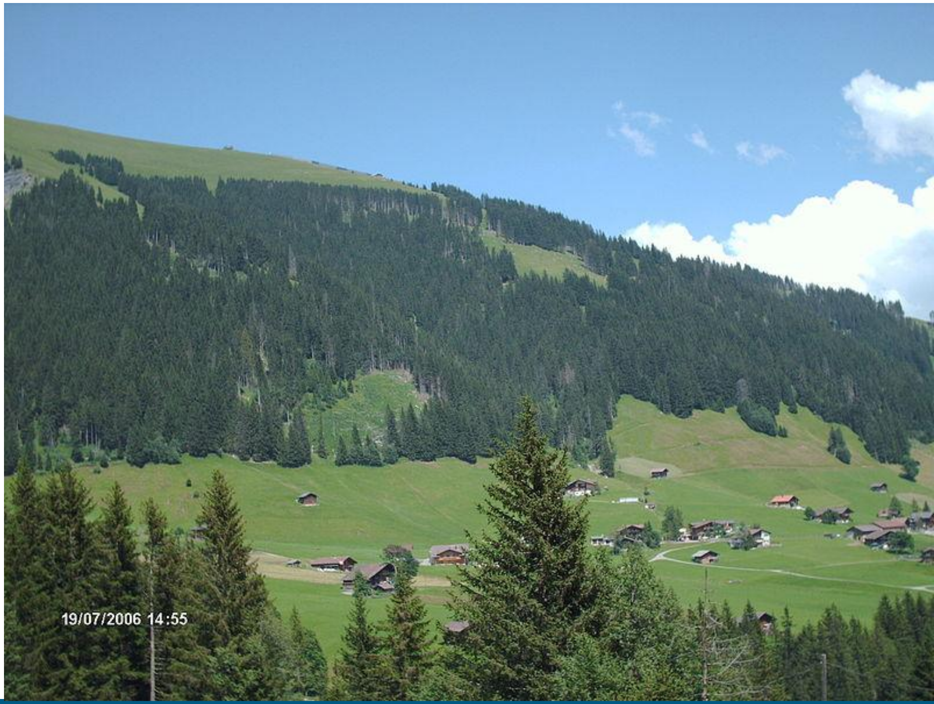
Examples

Adaptation actions may be needed to ensure **continued provision of ecosystem services** under climate change

Vulnerability analysis of Swiss protection forests:
increasing risks from forest fires, bark beetle infestation and wind throw

➡ Need to strengthen risk management mechanisms (e.g. early warning, use of site-adapted seedlings for planting)



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Synergies between ecosystem-based adaptation and mitigation

Role of ecosystem resilience

- Strengthening resilience of ecosystems to climate change impacts can ensure permanence of carbon stocks as well as continued delivery of services that are relevant to adaptation
- Ecosystem resilience can often be increased by **reducing non-climatic stressors and enhancing biodiversity**

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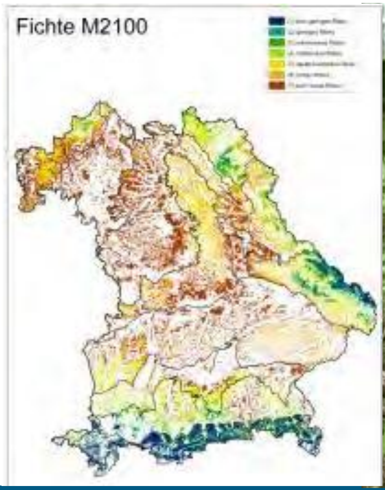
Example

Conversion of forests to adapt to climate change in Bavaria

The Bavarian Climatic Program foresees conversion of planted conifer stands into mixed stands on 260,000 ha of private and communal land and 165,000 ha of state forests. The aim is to make forest composition more natural, enhance resilience to climate extremes and protect biodiversity



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Source: Doswald & Osti 2011

Synergies between ecosystem-based adaptation and mitigation

Reducing likelihood of conflicting demands on ecosystems

- Adaptation actions can reduce the risk of future ecosystem damage through over-utilization – thus protecting carbon stocks
- Support to mitigation actions can increase amount of available funding for adaptation if synergies are used
- Combining mitigation and adaptation goals can facilitate harmonization of global and local perspectives

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Examples of ecosystem-based activities that support both mitigation and adaptation objectives

Reducing deforestation / forest restoration:

Possible adaptation contributions: prevent soil erosion, increase coastal protection, reduce risk of flooding and water shortages, enhance local food security, etc.

Peatland conservation / restoration:

Possible adaptation contributions: regulate water flows and local climate

Restoration / sustainable use of biological diversity in agriculture and forestry:

Enhanced diversity of crops and tree stands can increase size and resilience of ecosystem carbon stocks and reduce vulnerability of livelihoods

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Examples of possible conflicts between ecosystem-based mitigation and adaptation

Enhancing ecosystem carbon stocks through plantations:

Possible maladaptive effects if plantations are not planned and designed well: increased vulnerability to climatic extremes or pest outbreaks, higher water demand, more vulnerability to erosion, etc.

Replacing coastal ecosystem with artificial flood prevention structure:

Loss of carbon stocks and sequestration potential (as well as biodiversity and other ecosystem services)

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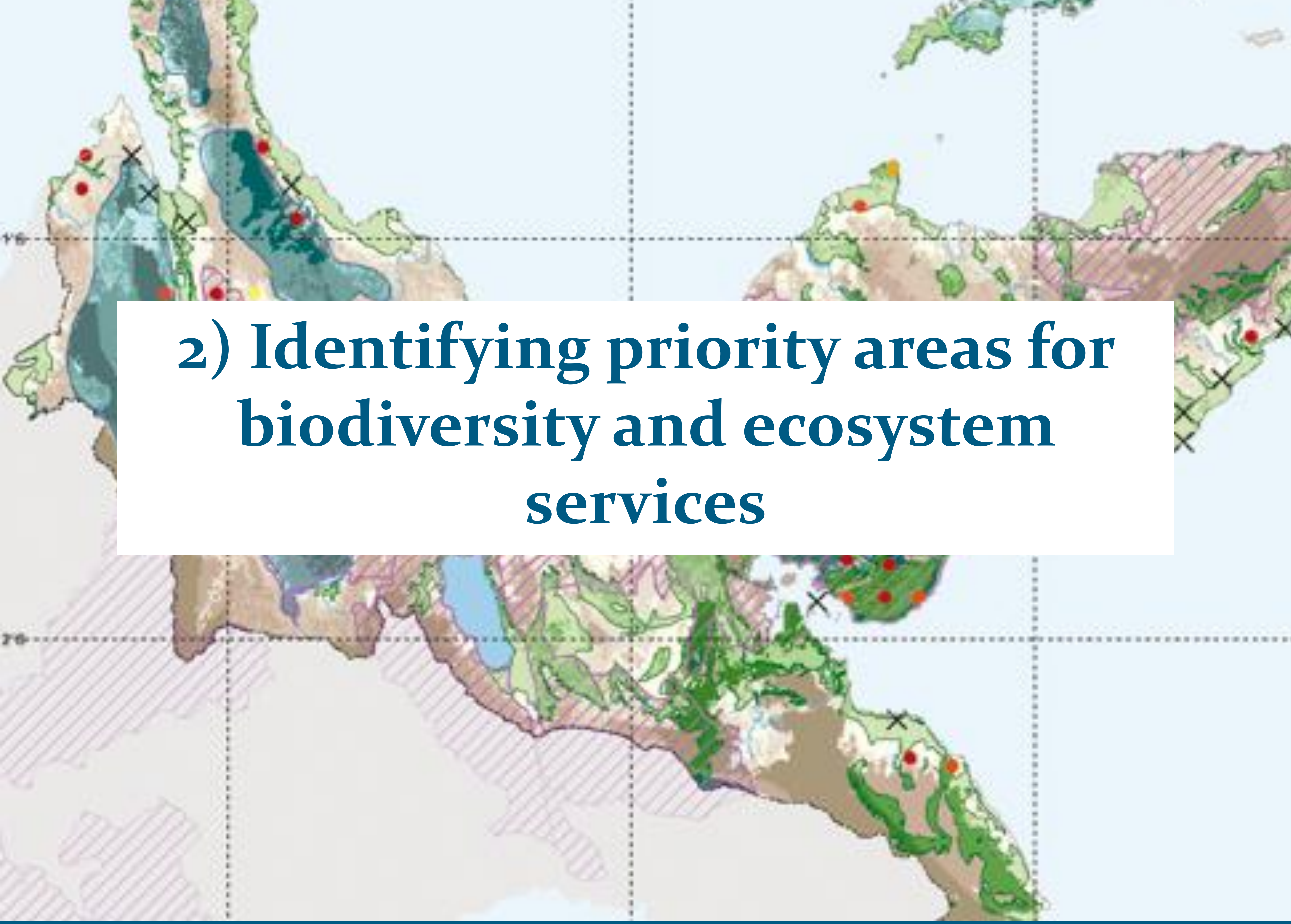

2) Identifying priority areas for biodiversity and ecosystem services

Why maps? - Need for spatial analysis

- Potential and demand for ecosystem services vary from one location to another
- Analyses of areas with high potential for mitigation and other ecosystem services can support achievement of synergies

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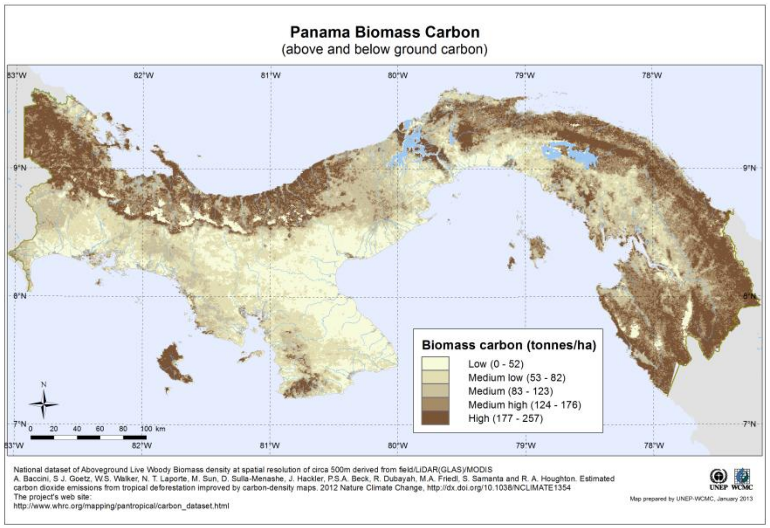
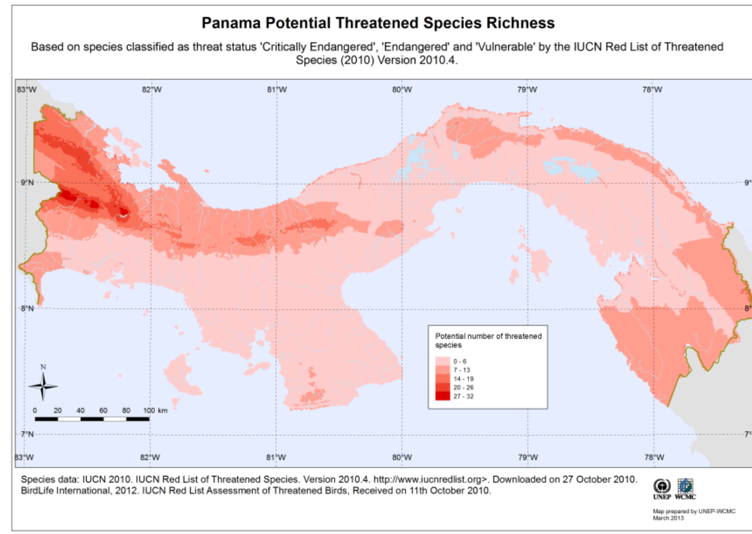
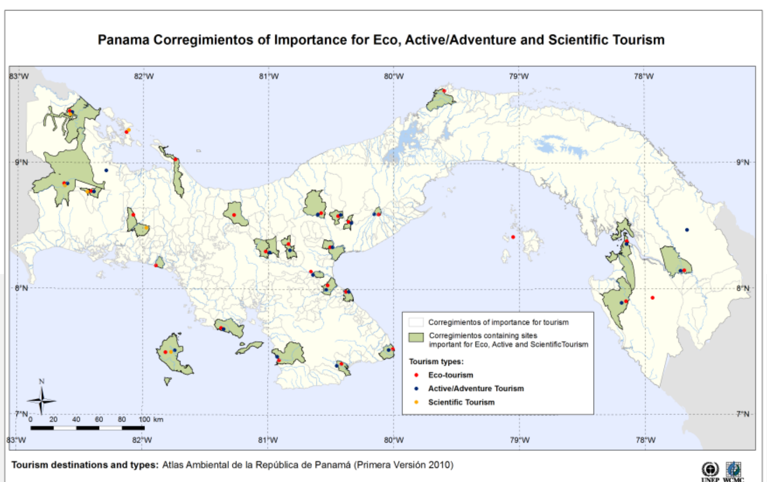
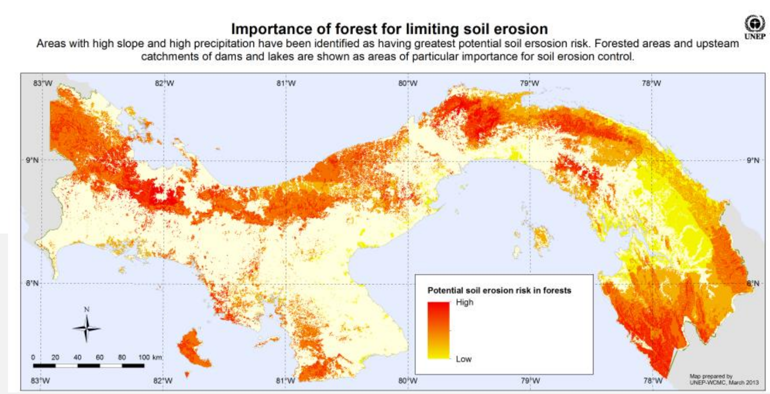
Example of an analysis combining multiple ecosystem services – carbon storage, species conservation, recreation and soil retention

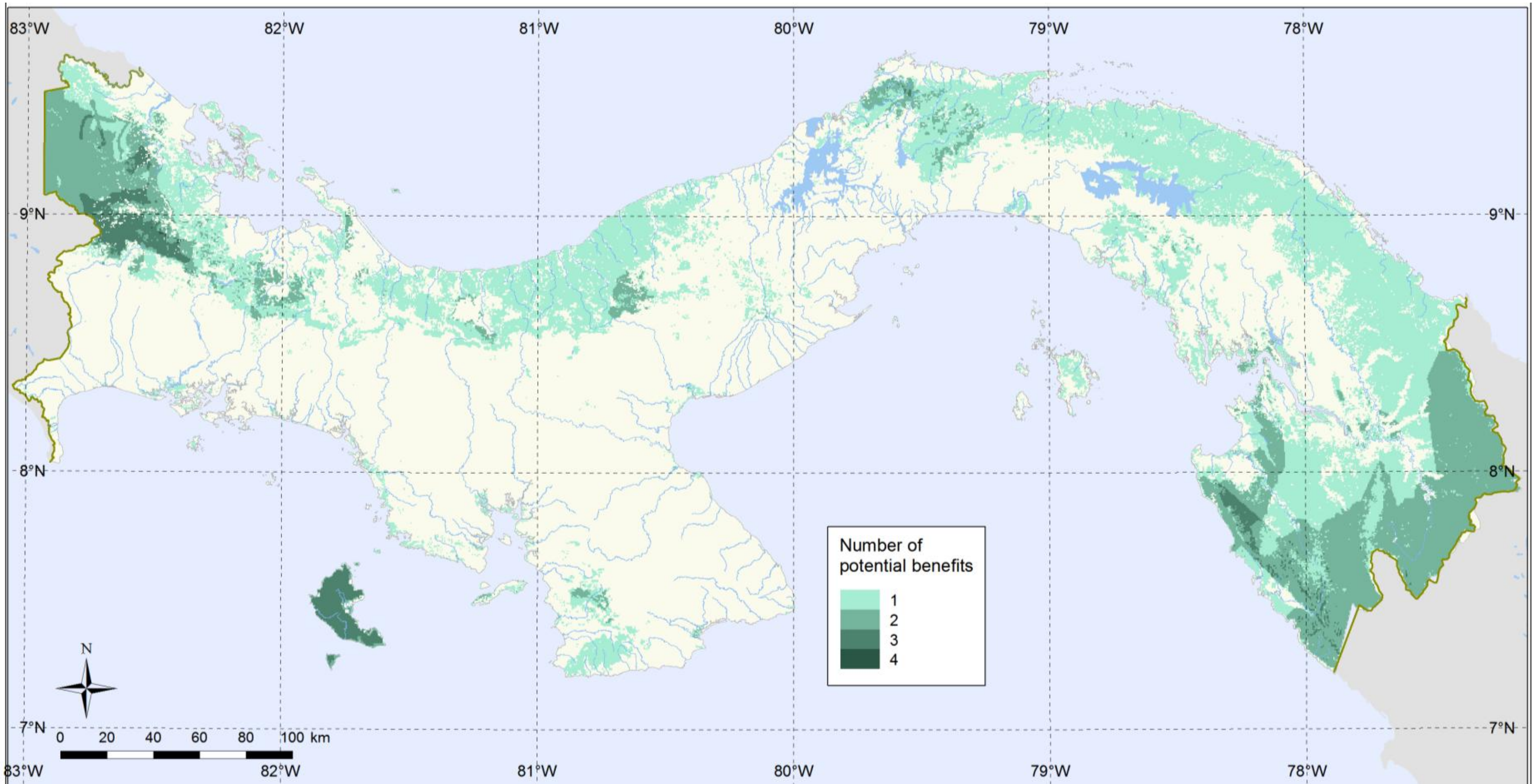








Assessment of overlaps



Methods and data sources:
Carbon: National dataset of Aboveground Live Woody Biomass density at spatial resolution of circa 500m derived from field/LiDAR(GLAS)/MODIS A. Baccini, S J. Goetz, W.S. Walker, N. T. Laporte, M. Sun, D. Sulla-Menashe, J. Hackler, P.S.A. Beck, R. Dubayah, M.A. Friedl, S. Samanta and R. A. Houghton. Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. 2012 Nature Climate Change http://dx.doi.org/10.1038/NCLIMATE1354. See: http://www.whrc.org/mapping/pantropical/carbon_dataset.html. The top two classes of biomass carbon "medium high" and "high" (see Panama Biomass Carbon map) were used to represent areas of highest importance for carbon in this map. Tourism: ANAM (2006) Corregimientos containing sites important for Eco, Active and ScientificTourism were selected and then clipped to forest area. Biodiversity: Key Biodiversity Areas (KBAs) of the world including Important Bird Areas (IBAs) and Alliance for Zero Extinction sites (AZEs) compiled by BirdLife International and Conservation International, October 2012. For further information, please contact mapping@birdlife.org. Soil erosion: Areas with high slope and high precipitation have been identified as having greatest potential soil erosion risk. The top two classes have been used to identify areas of greatest importance here (see map importance of forest for limiting soil erosion). Elevation: Lehner, B., Verdin, K., Jarvis, A. (2008): New global hydrography derived from spaceborne elevation data. Eos, Transactions, AGU, 89(10): 93-94. Precipitation: Hijmans, R.J., S.E. Cameron, J.L. Parra, P.G. Jones and A. Jarvis, 2005. Very high resolution interpolated climate surfaces for global land areas. International Journal of Climatology 25: 1965-1978. Forest: National dataset of 2008 land cover (CATHALAC & CATIE).

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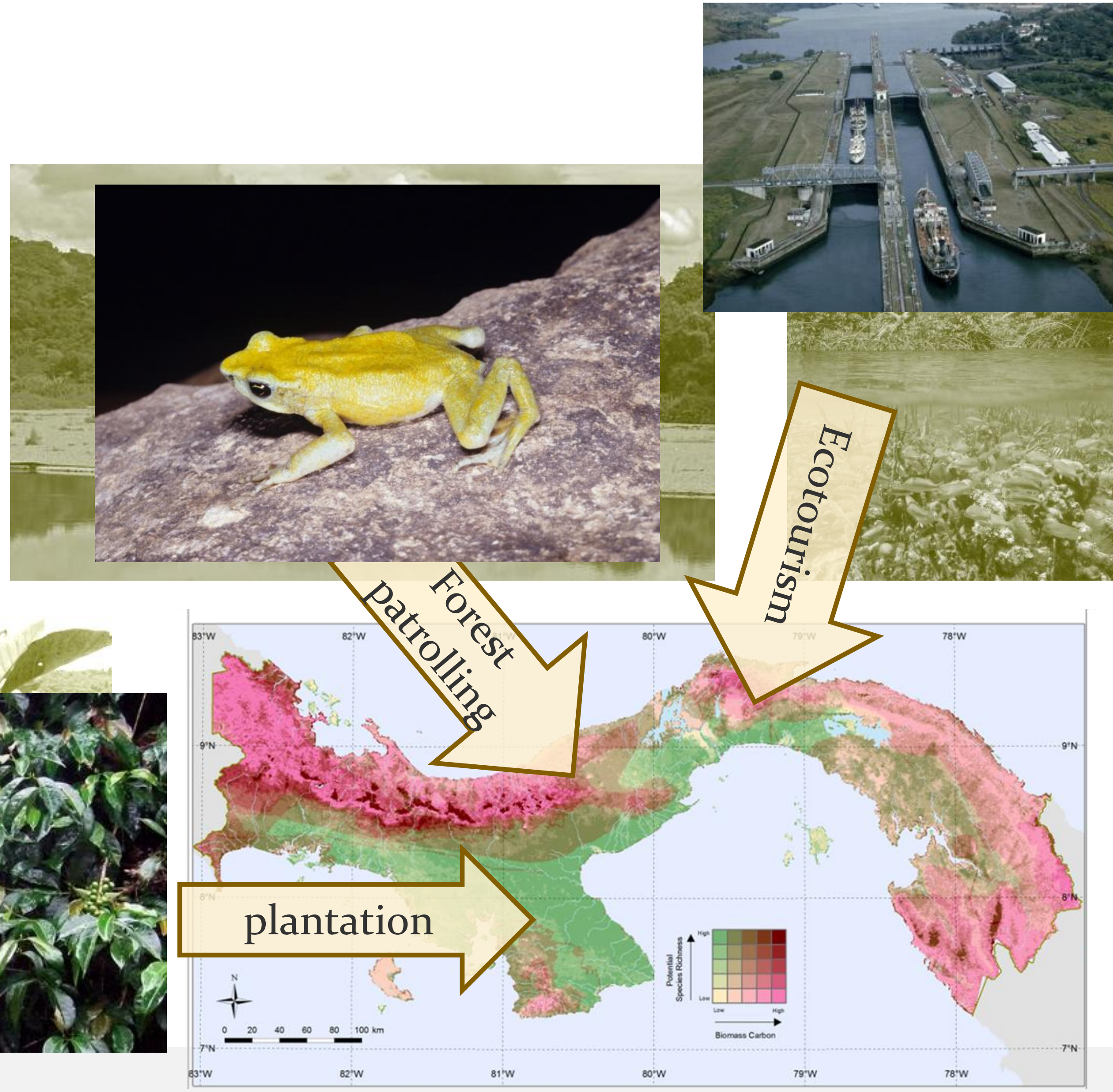
Map prepared by UNEP-WCMC 2013

3) Choosing appropriate management activities

Management decisions should consider both potential and demand for ecosystem services



- Even management activities that fulfill the same primary purpose can have very different implications for ecosystem services

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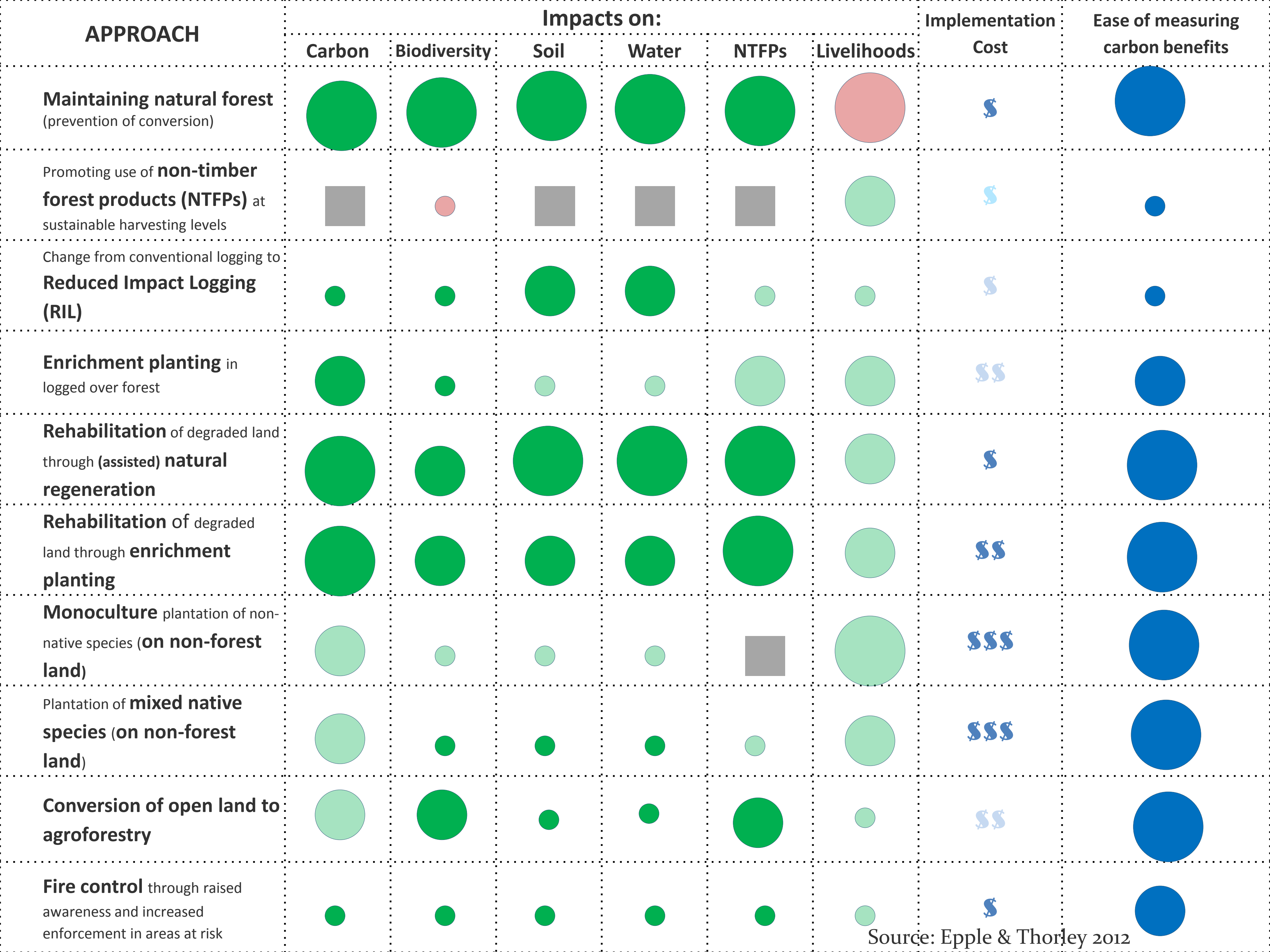

Source: Epple & Thorley 2012

4) Available knowledge and information gaps

- Growing body of information on approaches for ecosystem-based adaptation
- Increasing availability of tools for ecosystem service mapping, climate change vulnerability and impact analysis and spatial multicriteria analysis
- Still: data availability often limiting; further methodological development needed, e.g. with regard to assessments of ecosystem resilience to climate change

5) Conclusions

- Decisions on the management of ecosystems should consider impacts on a range of ecosystem services
- Prioritization of ecosystem services is needed and should be spatially explicit
- Integration of ecosystem-based mitigation and adaptation actions offers great potential for synergies
- Further research is needed on management options that enhance synergies and reduce trade-offs; IPBES could offer a platform for this

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Thank you!

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