

**PRESENTATION GIVEN AT THE TRANS LINKS VALUE CHAIN
WORKSHOP ENTITLED:**

**“Value Chain Cases in the Context of Conservation
Marketing and Certification”**

**JUNE 25-27, 2009
ARUSHA, TANZANIA**

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Ecological regulation of ecosystem services



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Conservation Marketing and Certification*

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Ecosystem service classification

- Millennium Ecosystem Assessment categories (MA 2003):
 - **Provisioning:**
 - – Marketed and subsistence goods
 - – food, wood, fiber, fresh water
 - – Genetic resources
 - **Supporting:**
 - – Ecosystem processes underlying provisioning ES
 - – productivity, soil formation, nutrient cycling
 - – some ecologists prefer simply “ecosystem processes”
 - **Regulating:**
 - – Play a regulatory role in ecological systems
 - – pollination; water purification; regulation of climate, natural disasters, diseases and pests
 - **Cultural:**
 - – Aesthetic, spiritual, educational, and recreational benefits

The semantics of ecosystem service supply

Ecosystem processes ... Ecosystem services ... Ecosystem function ... ???

Ecosystem Process (EP) — any transfer or transformation of energy or matter between pools (= stocks) in an ecosystem.

Key terrestrial ecosystem processes: productivity (NPP); decomposition; movement and cycling of carbon, water, nutrients, and energy; trophic interactions (predation, herbivory, etc.)

The semantics of ecosystem service supply

— *Ecosystem processes & Ecosystem services* —

Legend

Tropical rainforest

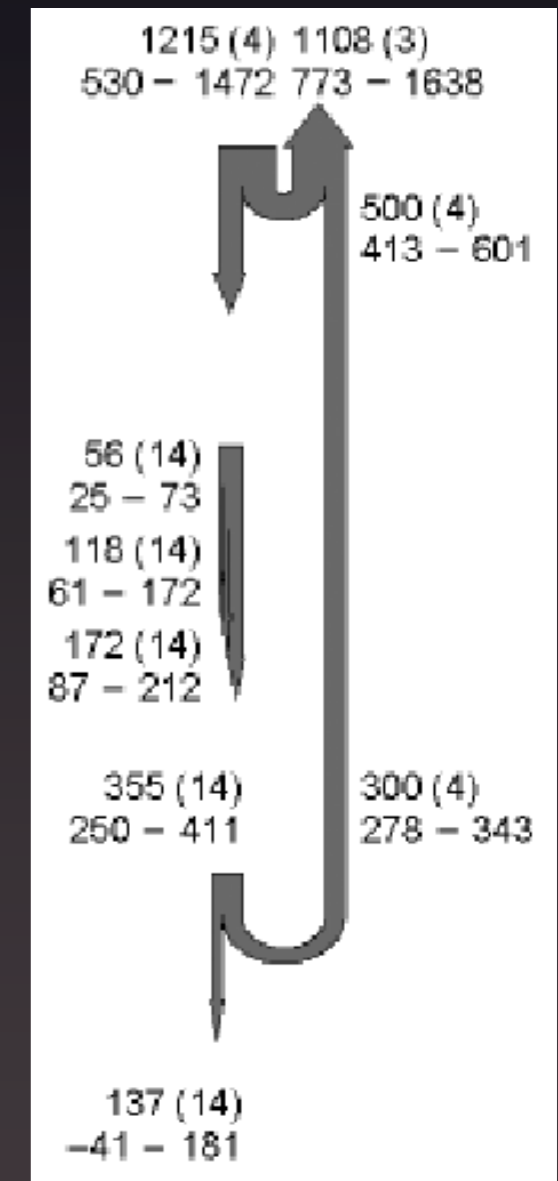
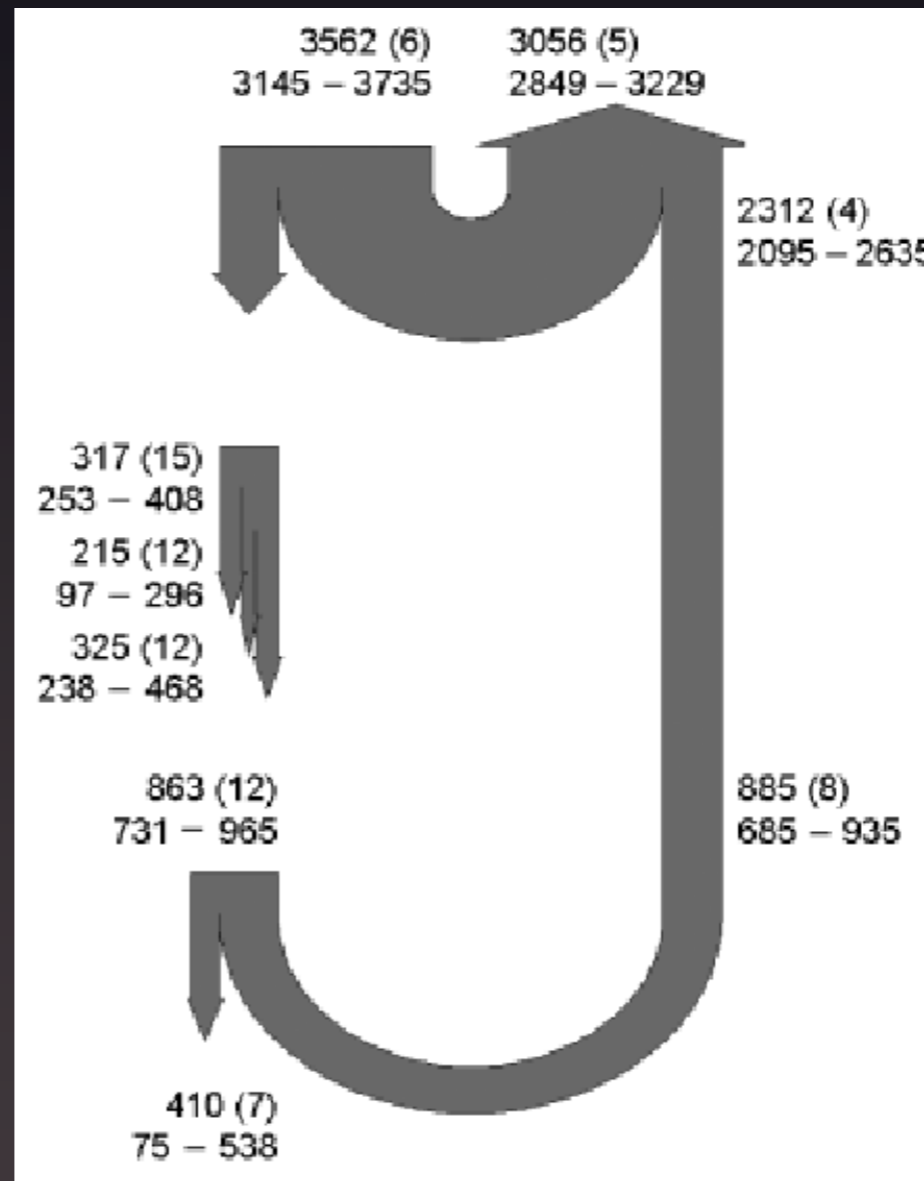
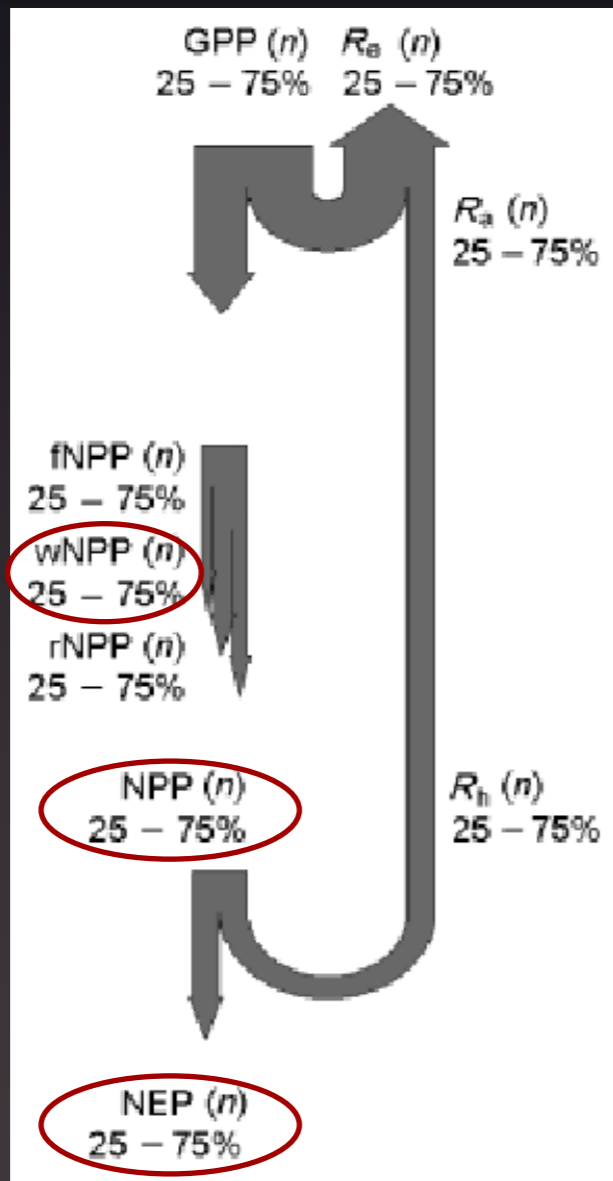
Semi-arid forest

Ecosystem services:

Provisioning
(wood)

Supporting
(productivity)

Regulating
(CO₂ sequestration)



Global Change Biology (2007) 13, 2509–2537, doi: 10.1111/j.1365-2486.2007.01439.x

CO₂ balance of boreal, temperate, and tropical forests derived from a global database

The semantics of ecosystem service supply

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Ecosystem Process (EP) — any transfer or transformation of energy or matter between pools (= stocks) in an ecosystem.

Key terrestrial ecosystem processes: productivity (NPP); decomposition; movement and cycling of carbon, water, nutrients, and energy; trophic interactions (predation, herbivory, etc.)

Ecosystem Service (ES) — any benefit to society from ecosystems, natural or managed (ecosystem disservices (EDS) are ecosystem costs to society)

Ecosystem Function — may be (i) an ecosystem process; (ii) an ecosystem property (stability, ecosystem modulators); or (iii) an ecosystem service.

Biophysical regulation of ecosystem services

- Biome scales:
- EP and ES are constrained by climate, soils, topography.
- For example, forests store more C than grasslands, & provide more consistent water supply.
- Local scales (& below):
- EP and ES are regulated by variation in:

Ecosystem service providers (ESPs): (Kremen 2005)

• A) abiotic conditions; B) biotic communities; & C) land management.
– **ESPs:** Biogeochemical cycles, plants, micro-organisms, invertebrates, birds, mammals

***Some ES rely on many (or all) ESP functional units, while others rely on a subset.

•***Fine-scale influences of organisms on ecosystems scale upward to regions & the globe.

Biological diversity & functional traits:– **Functional traits:** Determine the ES influence of

organisms, organismal diversity, biotic

communities, land use/cover and land use/cover diversity

– **Key plant functional traits:** Leaf chemistry (C; N; P; C quality; etc.), relative growth rate, photosynthate allocation pattern (wood; leaf; root; storage organs; secondary compounds; etc.)

Synergies & trade-offs between ES

- **ES Synergy:** The supply of a given ES increases along with the supply of one or more ES (i.e., **complementary** production function)
- **ES Trade-off:** The supply of a given ES decreases along with the supply of one or more ES (i.e., a **competitive** production function)
- Spatial and temporal mediation of ES synergies & trade-offs:
 - – Some are purely spatial, or purely temporal, but often both are involved.
 - – **Temporal mediation:** managing for an ES has lagging effects on other ES.
 - – **Spatial mediation:** managing for an ES in one area affects other ES, in other areas.
- Few synergies or trade-offs are universal — rather, they depend on:

Common trade-offs between ES in agroecosystems

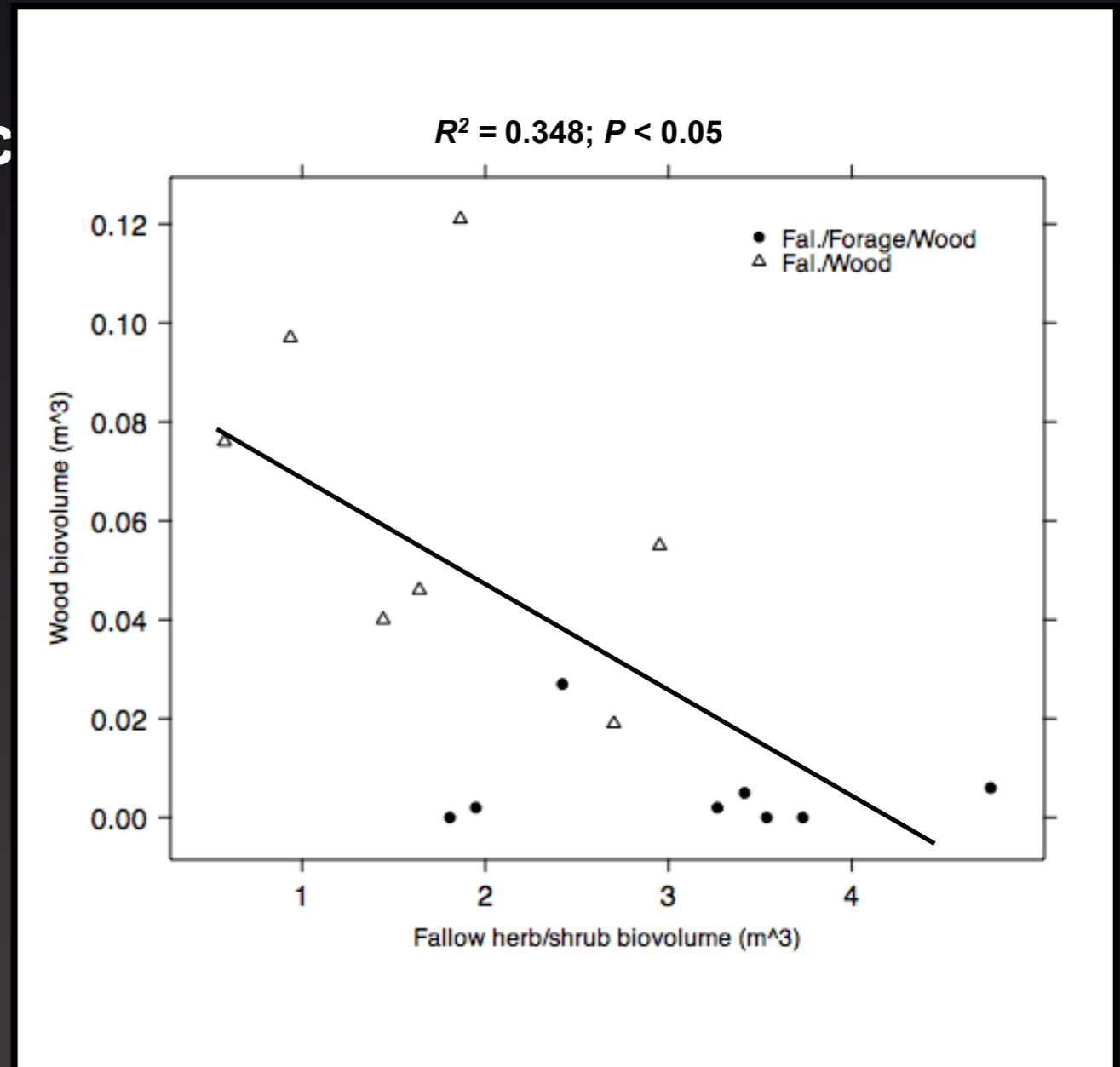
- ***Spatially-mediated trade-offs:***
 - Wood production / Livestock production
 - Wood production / Food production
 - Food production / Livestock production
 - Food production / Water supply regulation, Water purification, Soil retention
 - Food production / Regulation of pests, disease, & weeds
 - Food production / Pollination
 - Food production / Climate regulation (microclimate)
 - Livestock production / Water supply regulation, Water purification, Soil retention
 - Livestock production / Regulation of pests, disease, & weeds

Trade-offs between provisioning ES

- *Sauri Millennium Villages Project site, Nyanza Province, western Kenya:*

- **Wood production &**
- **Livestock forage produc**

- Fallows producing:
 - wood products only, or
 - wood and livestock forage
 - simultaneously



- *****Spatially-mediated trade-off:**

Common synergies between ES in agroecosystems

Spatially-mediated synergies:

- Wood production / Water supply regulation, Water purification, Soil retention
- Wood production / Regulation of pests, disease, & weeds
- Wood production / Climate regulation (microclimate)
- Wood production / Pollination

Temporally-mediated synergies:

- Wood production / Soil sustainability (fallowing/land restoration)
- Wood production / Climate regulation (global climate)

Synergies between provisioning ES

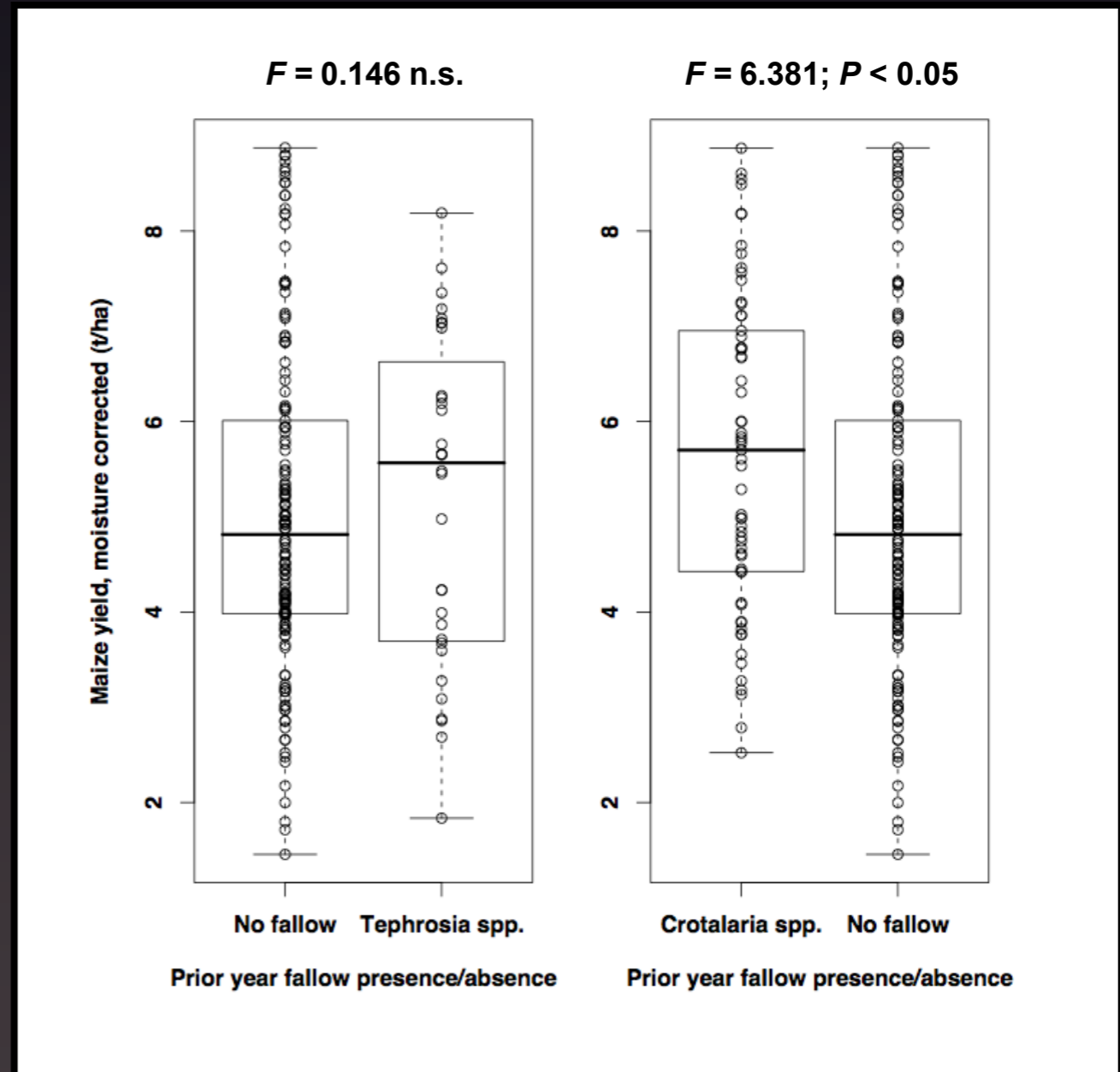
- *Sauri Millennium Villages Project site, Nyanza Province, western Kenya:*

- **Wood production &**

- **Maize production**

- Maize fields:

- after an improved fallow, or
- no fallow in the prior season



- *****Temporally-mediated synergy:**

ES Conservation & Markets

- In conservation circles, ES-centered approaches are relatively new, and are somewhat controversial (most conservation remains centered on species and wilderness).
- Ecosystem service projects:
 - – ‘Wildlife-friendly’ (WCS) and ‘Frontier market’ (WWF, TNC) programs:
 - – Often use payments for ecosystem services (PES), or certification (Tallis et al. 2009).
 - – Goals remain largely species-centered.
 - – ~~ES often used as a means to achieve these goals~~
 - – ~~How to handle trade-offs and synergies between ES?***~~
 - – ~~What are the most critical trade-offs and synergies for a particular product?~~
 - – Conservation certifications.
 - How can research and knowledge dissemination keep pace with practice?
 - – Leverage niche markets to value ‘biological value chains’, or ‘biological production functions’, which are often heavily discounted.
 - – Goals include reducing rates of deforestation, over-harvest, and land degradation.

Value Chain Development Tool

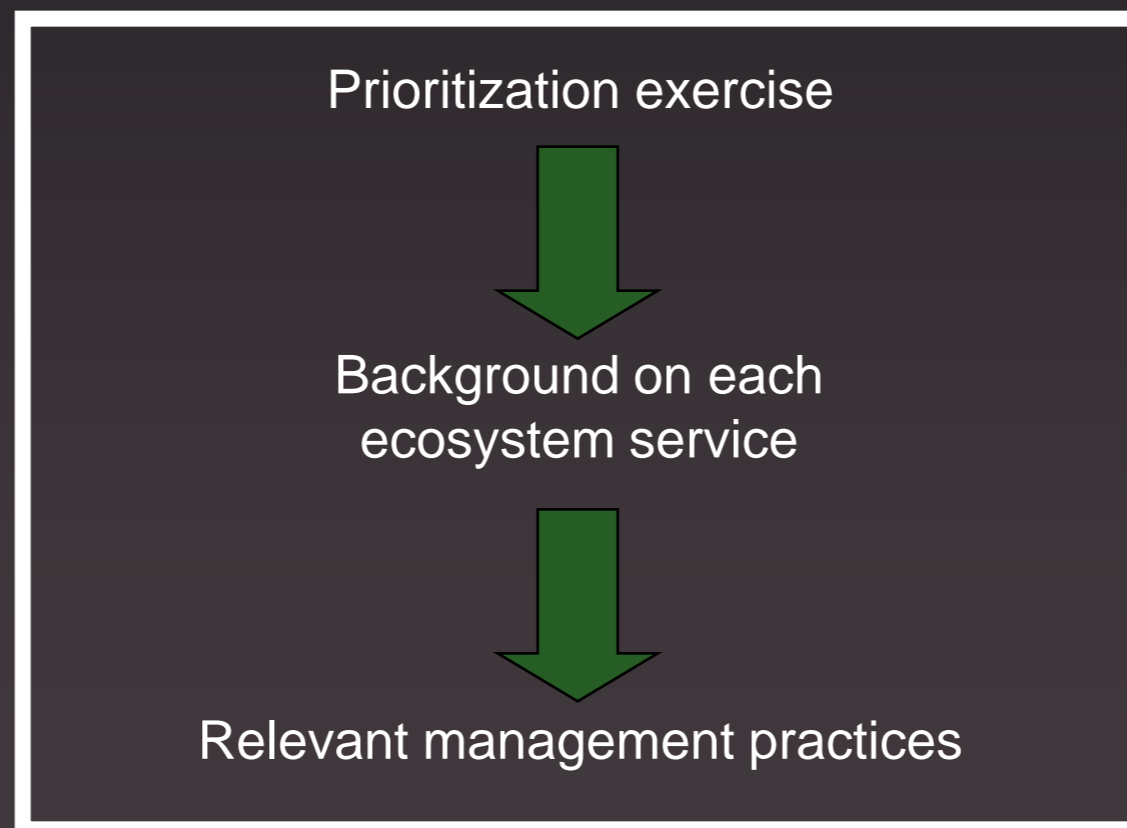
- The *value chain development tool* (VCDT) is a first-pass toolkit for ES-based planning and management, by explicitly incorporating ES into supply-side decision-making.
- Designed for use in agricultural systems, the VCDT considers both provisioning and non-provisioning ES that accrue from local (e.g., soil sustainability) to global scales (e.g., climate regulation).
- The VCDT emphasizes the ecological basis of ES delivery, to improve practical linkages between social and ecological spheres:
 - *ES origins*: Ecosystem service providers, and key components of biological diversity
 - *Resource management*: Strategies to support ecosystem functioning
- A key organizing concept is that an ES-oriented perspective on ES production illustrates trade-offs and synergies between ES, assisting in identifying...
 - pitfalls that may arise when 2+ ES have *competitive* production functions (**trade-off**)
 - opportunities when 2+ ES have *complementary* production functions (**synergy**)

Value Chain Development Tool


The first stage of creating the VCDT is the *Ecosystem Services Primer*.

ES Primer: Provides an ES knowledge base, facilitating global VCDT application in a variety of conservation and development contexts.

ES Primer structure:



Ecosystem Services Primer; Draft



Fuelwood and Timber

What is it?
In developing countries, makes up 80% of all trees felled. And although more pressure exists in urban settings, most of the trees/wood products are collected and used locally. Collection can be ad hoc, involve plantations or silvicultural systems. Tree resources include natural forests and mangroves, buffer zones, mountains, fires outside forests, agro forestry, plantations.

Benefits of Well-managed Fuelwood and Timber

- o Surplus enables selling and profiting
- o Maintenance of soil quality (see page 1)
- o Avoidance of conflict (from seeking timber further and further away into other people's territory)
- o Alternative to dung, which may be used as fertilizer
- o Managed systems minimize deforestation
- o Reduction in collection distances saves human resources
- o Relationship to food consumption/health (shorter cook times, more raw foods)
- o Availability has been linked to food from home to food produced for commercial production – supply and demand of individuals may affect agricultural choices.

Relationship to other ecosystem services
If deforestation, erosion, loss of soil sustainability and nutrients, also loss of other species and plant life that may have been in the forested area
Choices considering maintaining can help at a variety of levels
Climate Regulation: Fossil fuel emissions. Relationship to climate change. Also in reduced forest cover.



Interventions that help improve this service

Crop Management	Agroforestry	Infrastructure
Cover Crops Relay Crops Crop Rotations Green Manure Natural Fallows Reduced Tillage Perennial Cropping Mulching Composting	Hedgerows Tree Intercropping Woodlots Woodland Management Improved Fallows	Terracing Ponds Improved Cook-Stoves

Case Study

Mention in a particular study (CIFOR) of collectives having more difficulty in general to produce trees than individual farmers. Perhaps mention of usefulness/practicality for farmers to consider this need.

"In Niger, farmers faced with severe drought and desertification in the 1980s began leaving some emerging acacia tree seedlings in their fields as they prepared the land for crops. As these trees matured they slowed wind speeds, thus reducing soil erosion. The acacia, a legume, fixes nitrogen, enriching the soil and helping to raise crop yields. During the dry season the leaves and pods provide fodder for livestock. The trees also supply firewood. This approach of leaving 20 to 150 seedlings per hectare to mature on some 3 million hectares has revitalised farming communities in Niger."

Water Quality

What is it?
Seventy percent of surface water is used in some way toward agriculture. Irrigated agriculture is dependent on an adequate water supply of usable quality. Water quality concerns have often been neglected because good quality water supplies have been plentiful and readily available. This situation is now changing in many areas. Intensive use of nearly all good quality supplies means that new irrigation projects and old projects seeking new or supplemental supplies must rely on lower quality and less desirable sources.

Benefits of Improved Water Quality

- * Expected yields can be maintained
- * Crop damage less likely
- * Less water needed if infiltration is an issue (see below)
- * Salinity management: Salts in soil or water reduce water availability to the crop to such an extent that yield is affected.
- * Improves water infiltration rate: relatively high sodium or low calcium content of soil or water reduces the rate at which irrigation water enters soil to such an extent that sufficient water cannot be infiltrated to supply the crop adequately from one irrigation to the next.
- * Addresses Specific Ion Toxicity: Certain ions (sodium, chloride, or boron) from soil or water accumulate in a sensitive crop to concentrations high enough to cause crop damage and reduce yields.
- * Minimizes the probability of excessive nutrients, which can reduce yield or quality; improved marketability of products if deposits on fruit or foliage reduce marketability; reduction of equipment corrosion reduces maintenance and repairs.

Relationship to other ecosystem services

It is a cause through its discharge of pollutants and sediment to surface and/or groundwater, through net loss of soil by poor agricultural practices, and through salinization and waterlogging of irrigated land. It is a victim through use of wastewater and polluted surface and groundwater which contaminate crops and transmit disease to consumers and farm workers
Erosion leading to nutrification of waterways, reduced stream depth, turbidity – affecting aquatic resources as well as water quality for ag. uses such as irrigation

Crop Management	Agroforestry	Case Study
Cover Crops Relay Crops Stoves Crop Rotation Green Manure Natural Fallows Reduced Tillage Perennial Cropping Mulching Composting	Hedgerows Improved Fallows Tree Intercropping Wood Lots Improved Woodland Management	
Infrastructure	Livestock	
Terracing Improved Cook Stoves	Improved Grazing Grasslands Restoration Fire Management	

- **Goals:** Provide a practical guide to the essentials of ES delivery; (+) and (–) linkages between ES; prioritizing among ES; and commonly effective management strategies for various ES.
- **Target audience:** Lower- to mid-level practitioners and managers, in the fields of conservation, rural development, and PES in agricultural landscapes.

Value Chain Development Tool & Ecosystem Services Primer

- The value chain development tool (VCDT) will build from the knowledge base provided by the ES Primer.
- Potential ES Primer/VCDT applications include individuals and institutions engaged in:
 - Sustainable and/or diversified agricultural production
 - ‘Wildlife-friendly’ goods, ‘frontier markets’
 - PES programs
 - Management and conservation of publicly-accruing ES (including PES)
 - Landscape agricultural planning (including PES)

We’re keen to discuss this work, and to receive feedback from a variety of views, to improve the ES Primer and the VCDT. Please don’t be bashful...



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