Foundations of Forest Sustainability

B. Bruce Bare

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Forest Sustainability

- What to sustain and for whom?
  - area of forests?
  - productive capacity of forests?
  - condition or state of forests? (i.e., level of biodiversity, quantity of timber, etc.)
- What are the principal drivers effecting forests? (i.e., population, economy, social stability, climate, etc.)

Facts Check for Sustainability

- World population as principal driver
  - 7.3 billion
- World's land and forest areas
  - 13 billion hectares land
  - 3.79 billion hectares forest land
- Consumption of wood products
  - 3.53 billion m^3 /year
  - (53% wood fuel; 47% industrial)
  - about 1m^3 /hectare/year

Facts Check for Sustainability

- Per capita consumption of wood products

  3.53/7.3 = 0.48 m^3/person/year

- In 2050 with population of 9 billion how will wood needs be sustainably met?
  - 2 billion more people consuming 0.48 m^3/person or an additional 960 million m^3/year
  - Can achieve by: reducing wood consumption; recycling; switch to substitute materials; harvest more timber
- Existing stocks of timber are about 417 billion m^3 (3.8 billion hectares * 110 m^3/hectare)

Facts Check for Sustainability

- Annual production of 3.53 billion m^3 is 0.85% of existing inventory (i.e., less than 1%)
- Establish new plantations of fast growing species
- Assuming an average plantation production rate of 20 m^3/hectare/year and the need to produce an additional 960 million m^3/year by 2050, we need to establish about 48 million hectares of new plantation by 2050
- Or, reduce wood consumption about 19% from current level, so 9 billion people consume 3.53 billion m^3 which is about 0.39 m^3/year or about 3.5 billion m^3 /year

Natural Resources & Forest Sustainability

- Issues to contemplate (after Floyd):
  - Concept of sustainability has evolved over generations
  - Historically, forest protection, food production, population growth and development are inextricably linked
  - Today, these issues, **plus** -- global climate change, the search for new sources of energy (fossil and renewable sources), and food security add complexity to our search for sustainable solutions

Natural Resources & Forest Sustainability

- Issues to consider (after Floyd):
  - The things we want from our forests change over time: place of worship - solitude – source of food, fiber, and fuel – recreation - biodiversity – global climate mitigation – spans over 5,000 years of human history
  - Many things we want from forests are mutually exclusive at the local level – hence tradeoffs across uses are inevitable to avoid or minimize conflict

Natural Resources & Forest Sustainability

- Issues to consider (after Floyd):
  - In developed countries forest issues (today) involve enhancing biodiversity, protecting natural forests, and making our forests as resilient as possible in the face of climate change
  - In developed countries, population growth is slowing, food is cheaply produced on fewer acres and forest area is essentially constant with volume of timber increasing
  - In developed countries a big issue is how to balance intensive forest management (plantations) on some lands while protecting sensitive natural forests elsewhere and importing wood products from offshore

Natural Resources & Forest Sustainability

- In developing countries forests are used as fuel for cooking and heating
- In developing countries, forests are converted to agriculture and grazing to support larger human populations – forest area and timber volume are declining
- Trade offs exist between:
  - Forest plantations
  - Working forests
  - Protected forests

Shifting Forest Management Philosophy

- 19-20th Centuries
- Agricultural Model
- Utilitarian
- Output oriented
- Forest productivity
- Stand level
- Timber primacy (sustained yield)
- Multiple use / carrying capacity

- 21st Century
- Ecosystem Model
- Eco-centric
- State oriented
- Forest resiliency
- Landscape level
- Multi-resource (sustainability)
- Integrated use

Why a Paradigm Shift?

- Changing societal values of a growing, affluent, and urbanized population
- Growing awareness of the ecological and environmental implications of climate change and globalization of trade and business
- Living beyond the ecological limitations of our natural systems

Why a Paradigm Shift?

- Growing concern over loss of biodiversity in managed forests, fragmentation, invasive and endangered species, wildfire, clean water/air, recreation and forest health

21st Century Environment

- Combined, these influences have had a significant impact on the way we view our forest resources and how society expects them to be treated in the future
- Creates opportunities for new thinking and approaches

Context of Sustainability

- In USA, the evolution of conservation and sustainability began over 150 years ago with the Conservation Movement (Marsh, Hough, Fernow, Pinchot, T. Roosevelt). Preceded by Penn and Jefferson who tried to balance material use of forests with a more romantic concept where unspoiled forest virtues were stressed.
- Environmentalism was also prevalent with Emerson, Thoreau, Muir, Leopold and then later with Carson, Nelson (Earth Day) and UNCED (Rio 1992)

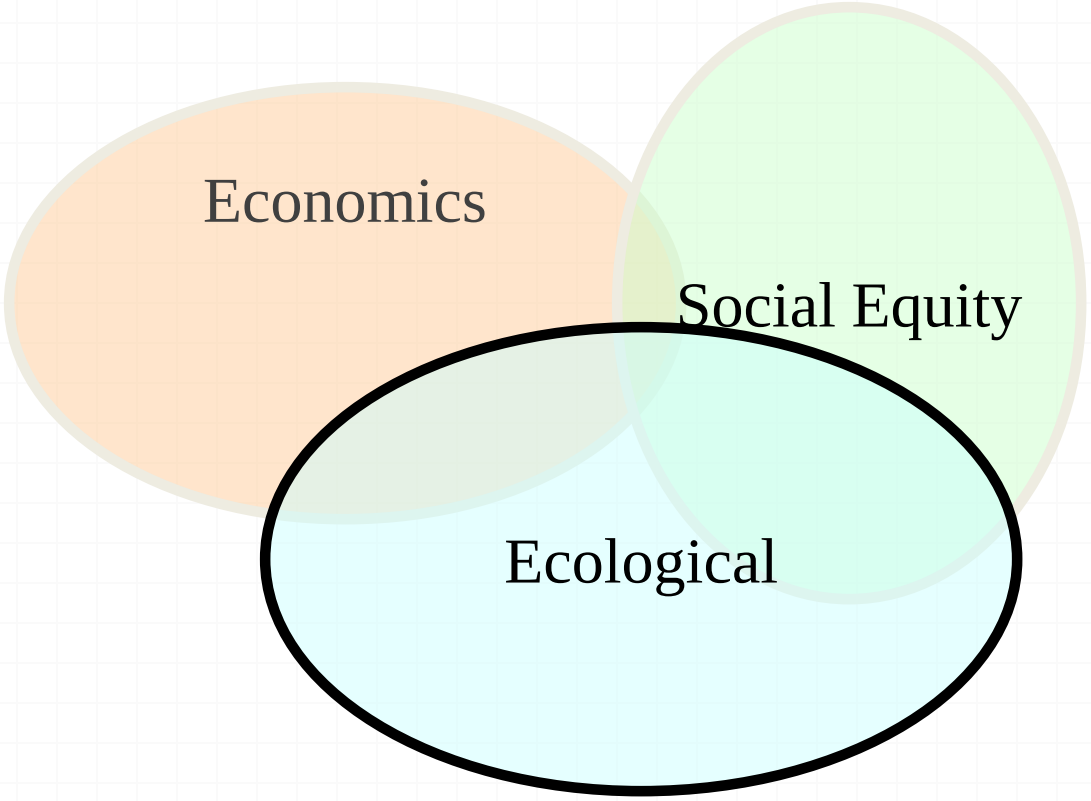
Context of Sustainability

- The UN established IPF (1995-97); IFF (1997-2000); UNFF (2000) to build political commitment for SFM
- Recently, the Paris Conference of the Parties (COP-21) recognized the important role of forests as carbon sinks
- The evolution of the conservation and environmental pathways have created the sustainability movement or revolution

Context of Sustainability

- Characteristics include (after Edwards, The Sustainability Revolution p.7)
  - Concern for environment, economy and social equity
  - Knowledge of limits of Earth's ecosystems and detrimental impact of unchecked human activities
  - Long-term, intergenerational perspective in actions and goals
  - Understanding our dependence on health of natural systems

Defining Sustainability



To Be Sustainable

- In the long run: resource consumption cannot exceed resource production
- Sustainability is related to concept of carrying capacity for wildlife populations – what population level to sustain without damaging the productive capacity of the resource into the future; also applies to forests.
- We need to consider our choices so that future generations will have options to use natural resources to best meet their needs

Source: Our Common Future, World Commission on Development and Environment, 1987

What Is Sustainability?

- A set of activities or processes that produce desired products and services over long periods of time (i.e., to sustain is to endure)
- Rational approach that seeks a dynamic equilibrium. Seeks to balance economic goals and ecological health in a socially acceptable manner
- Uses interdisciplinary set of social, ecological and economic sciences in an integrated fashion
- Is as much a social and economic as an ecological process

Sustainability

- A goal and not a specific endpoint
- A direction (i.e., a pathway) in conservation and forestry reflecting an evolution in societal perspectives and scientific knowledge

Source: Lindenmayer and Franklin, Towards Forest Sustainability, 2003

Conservation

- Conservation
  - Definition: to protect from loss or waste
  - The careful management (or stewardship) of the environment and of natural resources
  - Sustainability, conservation, and stewardship all imply the wise use of natural resources
- A means for achieving sustainability

Achieving Sustainability

- Complex undertaking
- Many stakeholders
- Multiple and conflicting goals (trade offs)
- Uncertainty
  - future societal needs
  - future state of ecosystem and unknown environmental factors
  - lack of complete understanding of ecosystem behavior and reaction to natural or man caused perturbations

Achieving Sustainability

- Value preferences expressed through the economic, political, and legal systems will largely determine the ultimate balance
- Requires that we adopt an integrated, holistic, adaptive approach that simultaneously considers all values and stakeholders

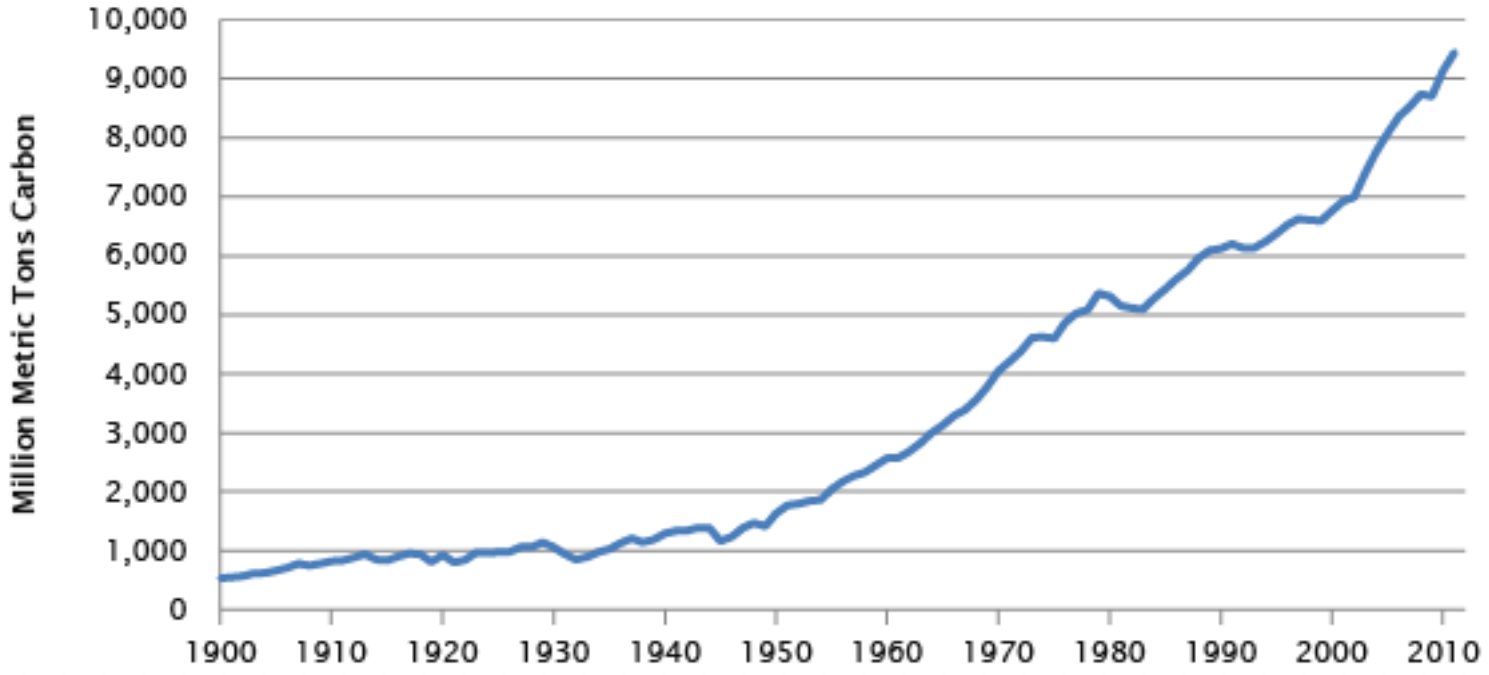
Climate Change and Sustainability

- In 2000, globally, forests sequestered carbon (about 4 gigatons (m)/ year of C) -- about 60% of the 6.7 gigatons (m) of total emissions from fossil fuel burning
- About 2 gigatons (m) were sequestered by the oceans
- Tropical deforestation released almost 3 gigatons (m)/year, with net result of about 1 gigaton (m)/year net forest carbon sequestered

Climate Change and Sustainability

- Tropical forests (thru deforestation) release about as much carbon as they sequester)
- But, if tropical deforestation continues and droughts and forest fires become more common, these forests could become a large atmospheric carbon source
- Coupled with disturbances to boreal forests and peatlands, things could get worse

Global Carbon Emissions from Fossil-fuels 1900-2011



Climate Change and Sustainability

- In 2007, annual emissions from burning fossil fuels in the USA were about 1.6 gigatons (m)/year of carbon (in 2014 1.5 gigatons (m))
- Annual sequestration was about 0.5 gigatons (m)/year -- associated with forests and harvested wood products and to a lesser degree from shrubs, agricultural soils, rivers, wetlands and reservoirs
- Can we achieve our goal of sustainable forests in the presence of global climate change?

Multiple Use

- Historically used as a policy instrument for rationalizing uses across a landscape
- Too closely identified with forest outputs instead of desired future states. Multiple use must be modified to meet the changing demands of society.
- A new paradigm that extends our traditional reliance on multiple outputs is needed. Sustainability offers this promise.

Conclusion

- Many challenges to achieve sustainability of our natural resources as we look towards 2050
- How to protect our natural resources while meeting the needs of society around the world for the goods and services forests produce

http://faculty.washington.edu/bare/esrm300lect1.pdf

The End