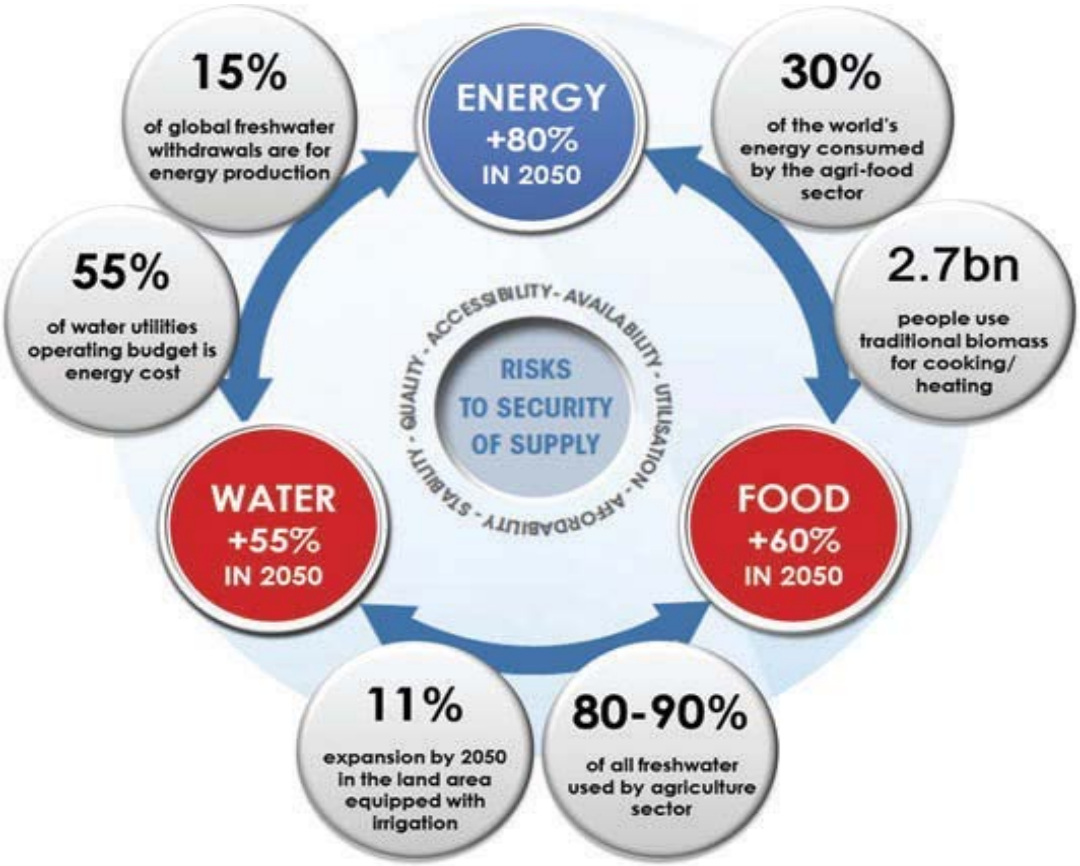
Food-Water-Energy-Land Approach to Community development

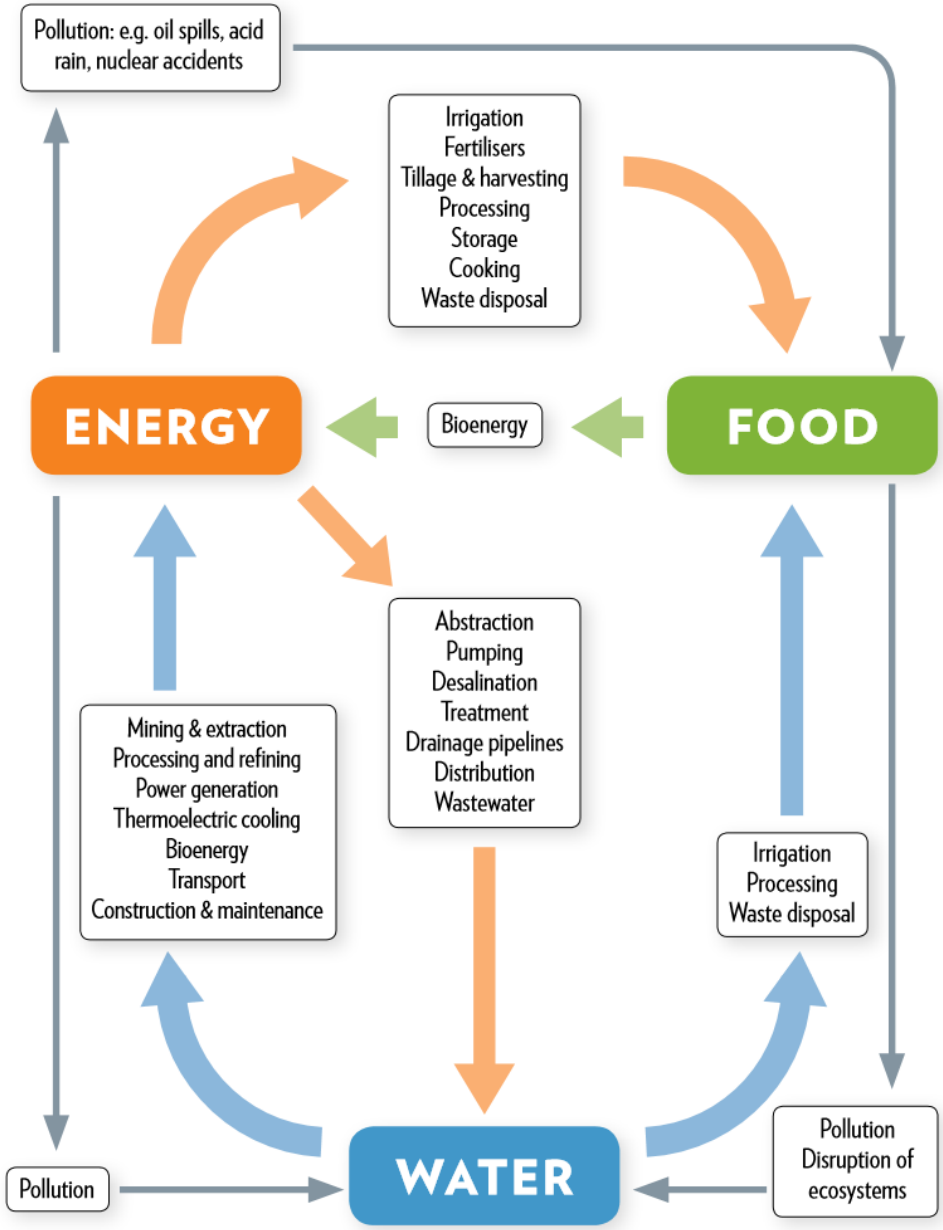
Bernard Amadei
Mortenson Center in Engineering for Developing Communities
University of Colorado, Boulder

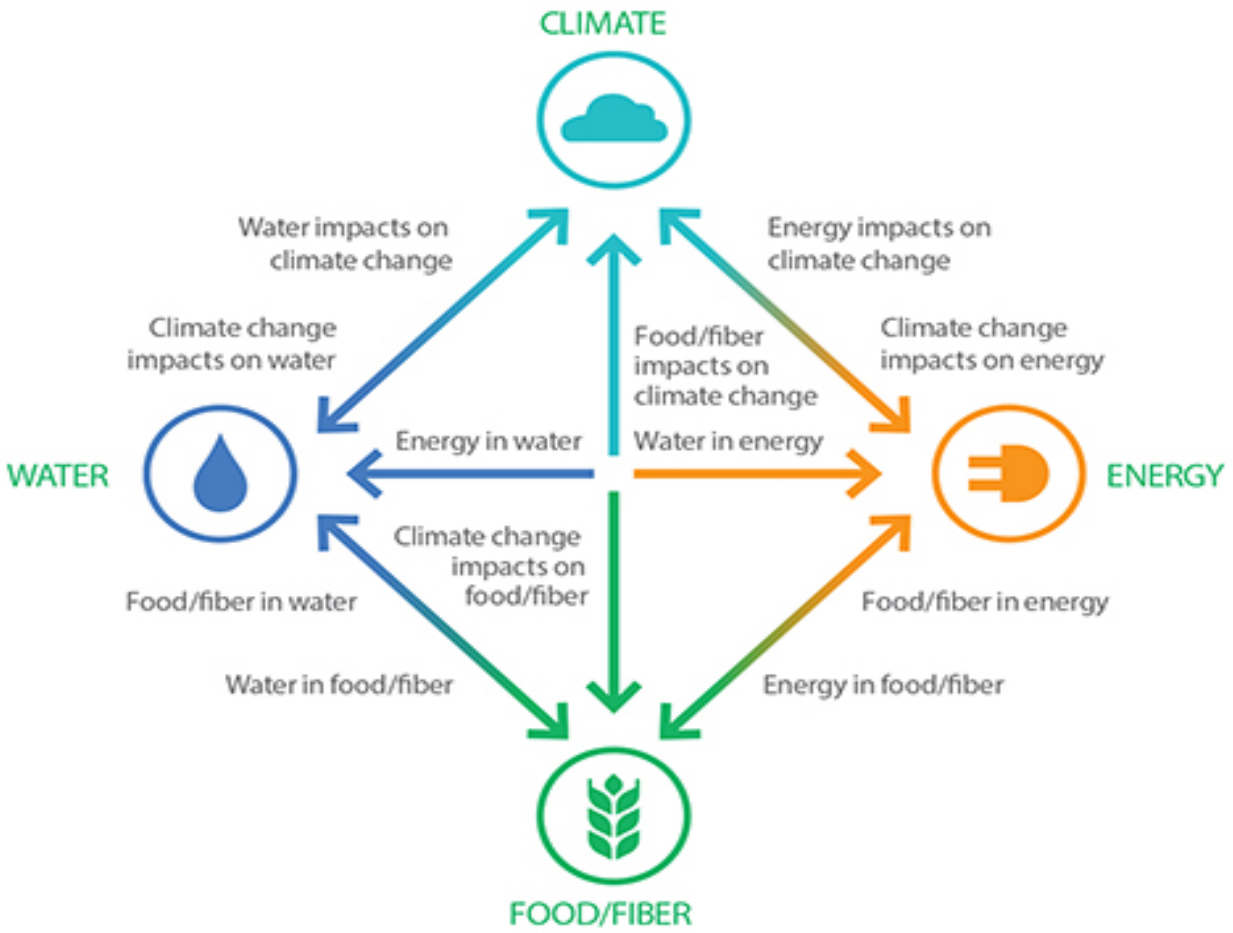
February 21, 2017

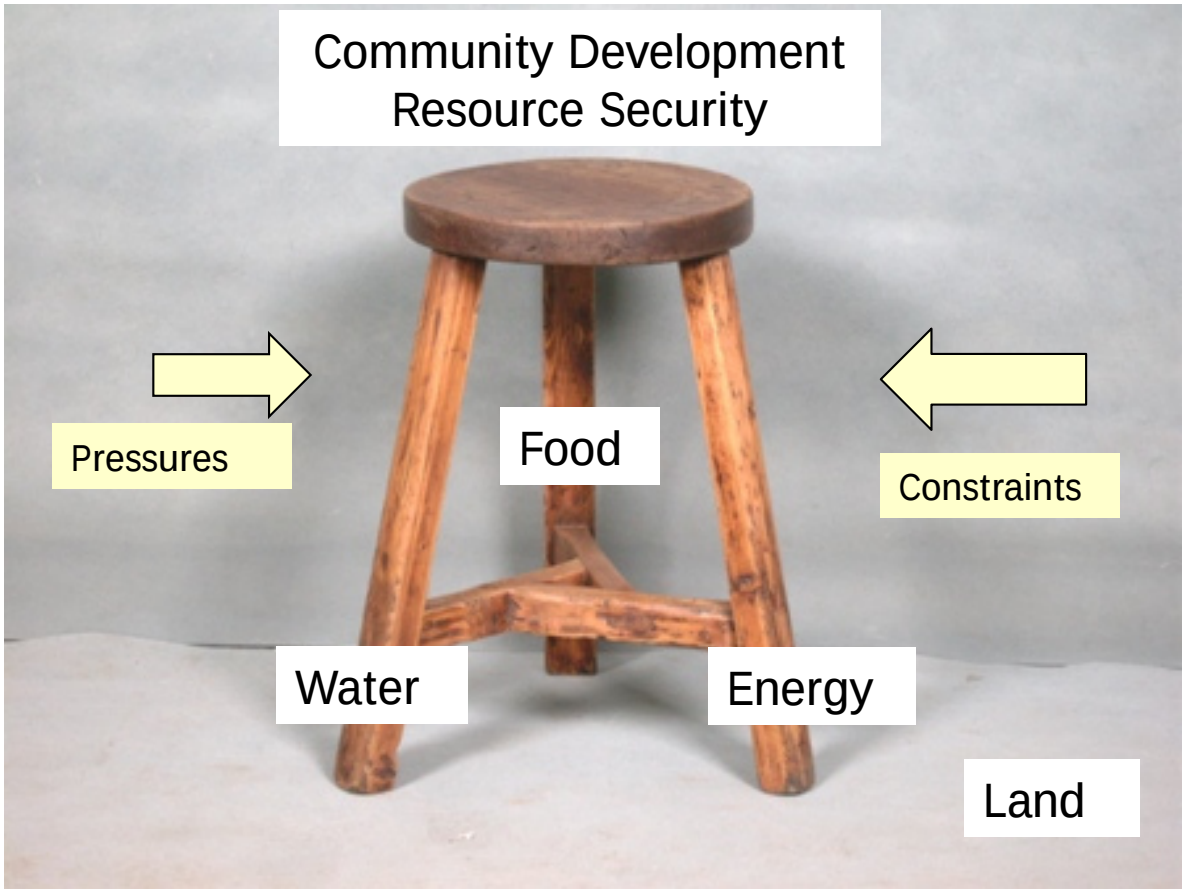


(Ferroukhi et al., 2015)

- *"A rapidly rising global population and growing prosperity are putting unsustainable pressures on resources. Demand for water, food and energy is expected to rise by 30-50% in the next two decades, while economic disparities incentivize short-term responses in production and consumption that undermine long-term sustainability. Shortages could cause social and political instability, geopolitical conflict and irreparable environmental damage. Any strategy that focuses on one part of the water-food-energy nexus without considering its interconnections risks serious unintended consequences." Global Risks 2011* (WEF, 2011);


Pollution: e.g. oil spills, acid rain, nuclear accidents
Irrigation
Fertilisers
Tillage & harvesting
Processing
Storage
Cooking
Waste disposal
ENERGY
Bioenergy
FOOD
Abstraction
Pumping
Desalination
Treatment
Drainage pipelines
Distribution
Wastewater
Mining & extraction
Processing and refining
Power generation
Thermoelectric cooling
Bioenergy
Transport
Construction & maintenance
Irrigation
Processing
Waste disposal
WATER
Pollution
Pollution
Disruption of ecosystems


CLIMATE
Water impacts on climate change
Energy impacts on climate change
Climate change impacts on water
Food/fiber impacts on climate change
Climate change impacts on energy
WATER
Energy in water
Water in energy
ENERGY
Climate change impacts on food/fiber
Food/fiber in water
Food/fiber in energy
Water in food/fiber
Energy in food/fiber
FOOD/FIBER


Community Development
Resource Security
Pressures
Food
Constraints
Water
Energy
Land

Double Causality Table

	Water Security	Energy Security	Food/Ag Security	Land/Soil/Veg Security
Water Resources		Water for energy extraction and production, and biofuel processing	Water for agricultural production and irrigation	Water contributes to soil and aquifer replenishing and vegetation growth
Energy Resources	Energy to run water infrastructure, pumping, irrigation, and desalination		Energy for mechanized agriculture, land preparation, irrigation, fertilization, etc.	Energy for field preparation, irrigation, and harvest
Food/Ag Resources	Food demand and diet affect water use	Food, agricultural residues and biomass used for production of biofuels and biogas		Agricultural practices impact land and vegetation
Land/Soil/Veg Resources	Soil type and vegetation regulate soil water saturation and groundwater	Soil type and vegetation affect the energy consumption for land use	Soil type and land characteristics affect crop yield	

Integrated and Participatory Community-Based Nexus Resource Management

- Food security takes place when "... all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active, healthy life" (FAO, 1996).
- Energy security is about "... the uninterrupted availability of energy sources at an affordable price" (IEA, n.d.).
- Water security guarantees "... the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability" (UNU-INWEH, 2013).

Integrated and Participatory Community-Based Nexus Resource Management

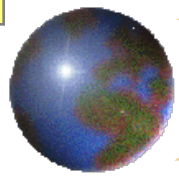
- Soil security is about: “the maintenance and improvement of the world’s soil resources so that they continue to provide food, fiber, and fresh water, make major contributions to energy and climate sustainability, and help maintain biodiversity and the overall protection of ecosystem goods and services” (Koch et al., 2013).
- Land security refers to “people’s ability to control and manage land, use it, dispose of its produce and engage in transactions, including transfers” (IFAD, 2015).

General Remarks

- The nexus is essential to human development *everywhere* on the planet and is an integral part of the global sustainability worldwide agenda (SDGs)
- The nexus needs to be considered with an integrated (e.g. systemic) perspective by considering (i) the water, energy, and food components and their life-cycles (i.e. flow supply chains from acquisition, consumption, and to waste disposal); (ii) the links between the components and their life cycles; and (iii) the interaction of the nexus as a whole with natural, human, infrastructure, and other systems
- The nexus cannot be separated and understood in isolation from the environment and the systems it interacts with.
- Even though the needs for water, energy, land and food are universal, addressing these needs and their interactions is context and scale specific.

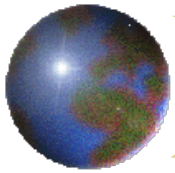
Rating	+3	+2	+1	0	-1	-2	-3
Type of influence	Enabling Essential	Enabling Supporting	Enabling Allowing	Consistent Neutral	Constraining Limiting	Constraining Reducing	Constraining Stopping
Explanation	Required to achieving security	Aids at achieving security	Enables security	No positive or negative effect	Limits achieving security	Restricts possibility of achieving security	Prevents and makes impossible to achieve security

	Water Security	Energy Security	Ag./ Food Security	Land/Soil Security	**Total Influence**
Water Resources		0 0	+3 -2	+3 -1	**+6** **-3**
Energy Resources	+2 -1		+2 -1	+1 -1	**+5** **-3**
Ag./Food Resources	+2 -1	0 0		+2 0	**+4** **-1**
Land/Soil/Veg. Resources	+2 -1	+1 0	+2 -1		**+5** **-2**
Total Dependence	**+6** **-3**	**+1** **0**	**+7** **-4**	**+6** **-2**	



Sustainable Development Projects

- Take responsibility for their effects on the natural world by doing no harm and not diminishing the diversity of its systems
- Create structures and systems of durability and long term utility whose ultimate use or disposition will not be harmful to current and future generations
- Change the conversation by educating all stakeholders involved
- Deliver efficient and resource-conserving solutions that reduce consumption, energy use, distribution costs, economic concentration, soil erosion, atmospheric pollution and other forms of environmental damage
- Consider what they take, make and waste
- Deliver solutions that work in harmony with the assimilative and regenerative capacity of the Earth's systems



SCD as a process toward creating communities that..

- Allow *all* of their members to enjoy a quality of life where basic human needs and rights and meaningful work are fulfilled in a safe and secure environment.
- Have equitable access to resources and knowledge, thus capable of sustaining themselves economically, socially, and environmentally
- Create potential for individuals and households to express their full potential without adversely and irreversibly affecting the carrying capacity of the environment upon which they depend.

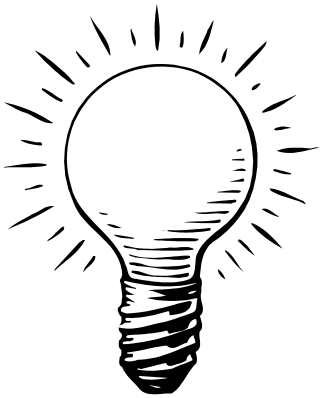
SCD as a process toward creating communities that..

- are places where rule of law and good governance are the norm; and
- ensure sustainable livelihood opportunities for future generations.

These five key characteristics contribute to an overall increased level of livelihood, security, and well-being in the basic economic and social units that form the community, i.e. the households

"The significant problems we face today cannot be solved at the same level of thinking we were at when we created them."

Albert Einstein



Contact: amadei@colorado.edu