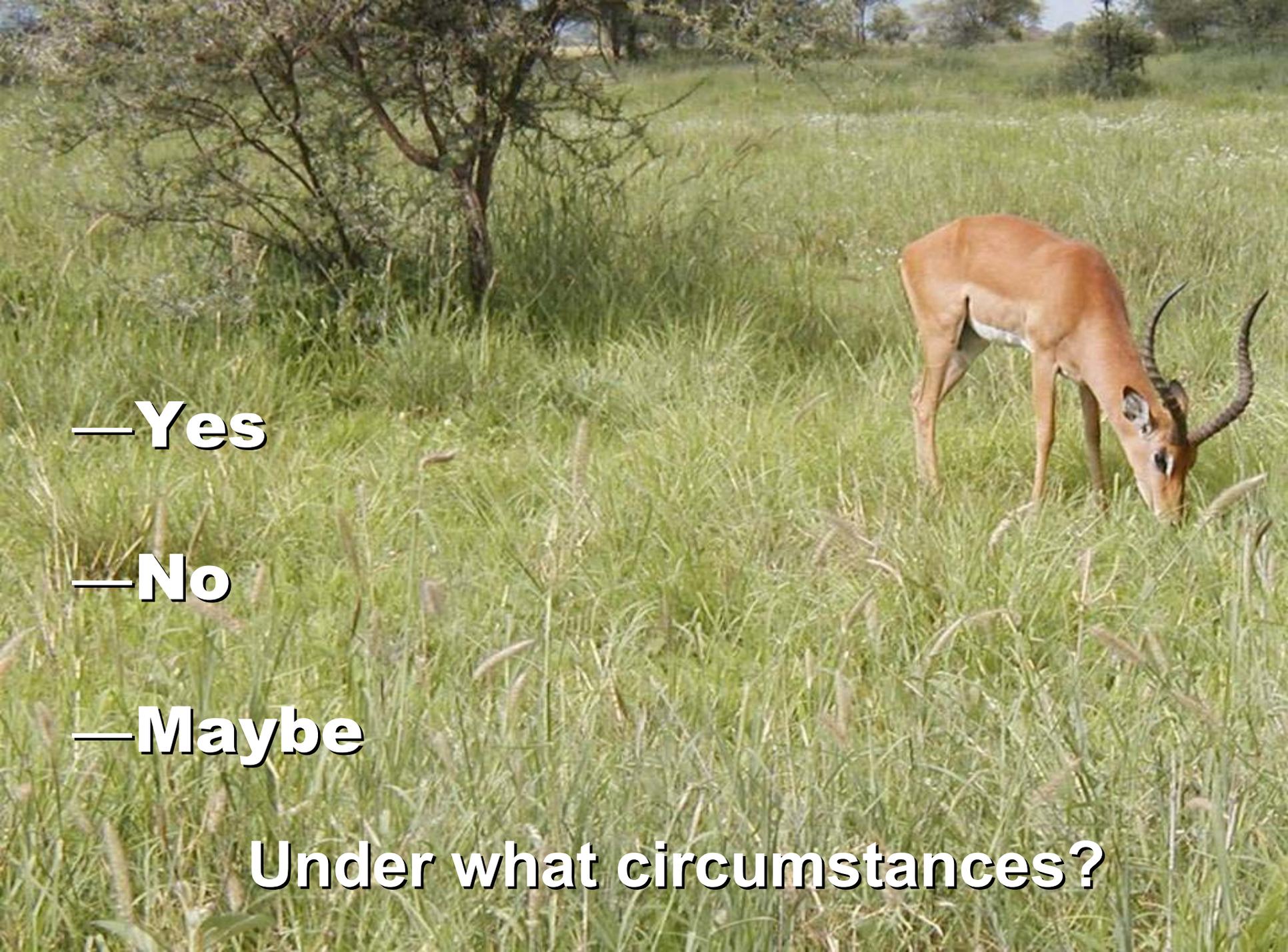


Can integration of crops and livestock contribute to sustainability in agriculture?

Alan J.
Franzluebbers
Ecologist



Watkinsville GA



—Yes

—No

—Maybe

Under what circumstances?

Who would be involved?

— **Farmers**

— **Landowners**

— **Agribusiness**

— **Farm advisors**

— **Researchers**

— **Environmentalists**

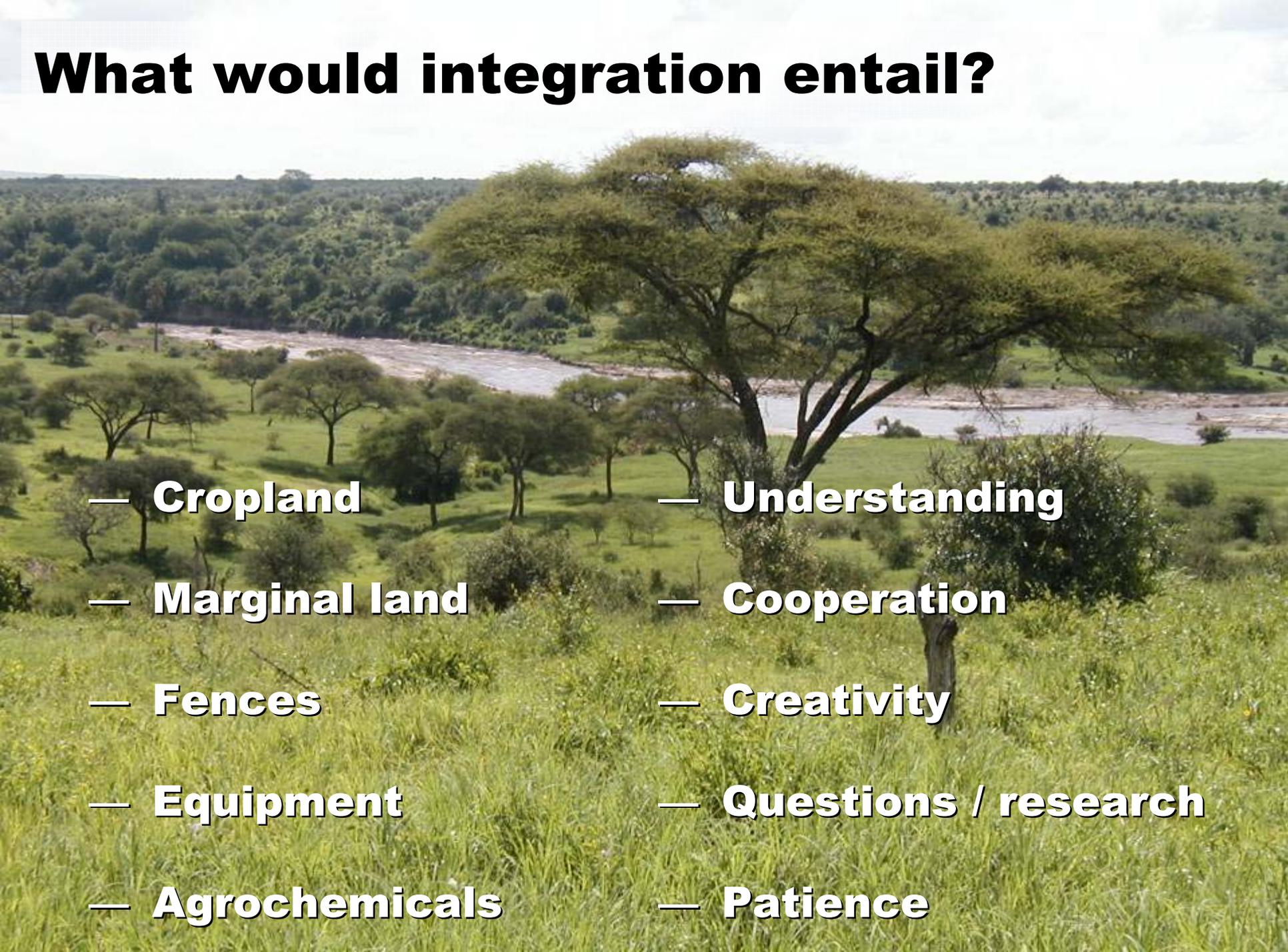
— **Food processors**

— **Marketers**

— **Health professionals**

— **Politicians**

What would integration entail?

A landscape photograph of a savanna. In the foreground, there is a large, spreading acacia tree with green foliage. The ground is covered in tall, green grass. In the middle ground, a wide river flows through a valley, surrounded by more acacia trees and greenery. The background shows a dense line of trees under a bright, slightly overcast sky.

— **Cropland**

— **Marginal land**

— **Fences**

— **Equipment**

— **Agrochemicals**

— **Understanding**

— **Cooperation**

— **Creativity**

— **Questions / research**

— **Patience**

Why are integrated crop / livestock systems needed?

Production

- ✓ Farms operating on marginal profit
- ✓ Economic vulnerability with specialized production
- ✓ High cost of fuel and nutrients
- ✓ Pests become greater with monocultures
- ✓ Yield decline could be overcome with rotation

Environment

- ✓ Nutrient recycling could be improved in both systems
- ✓ Conservation of soil and water possible with sod-based management systems

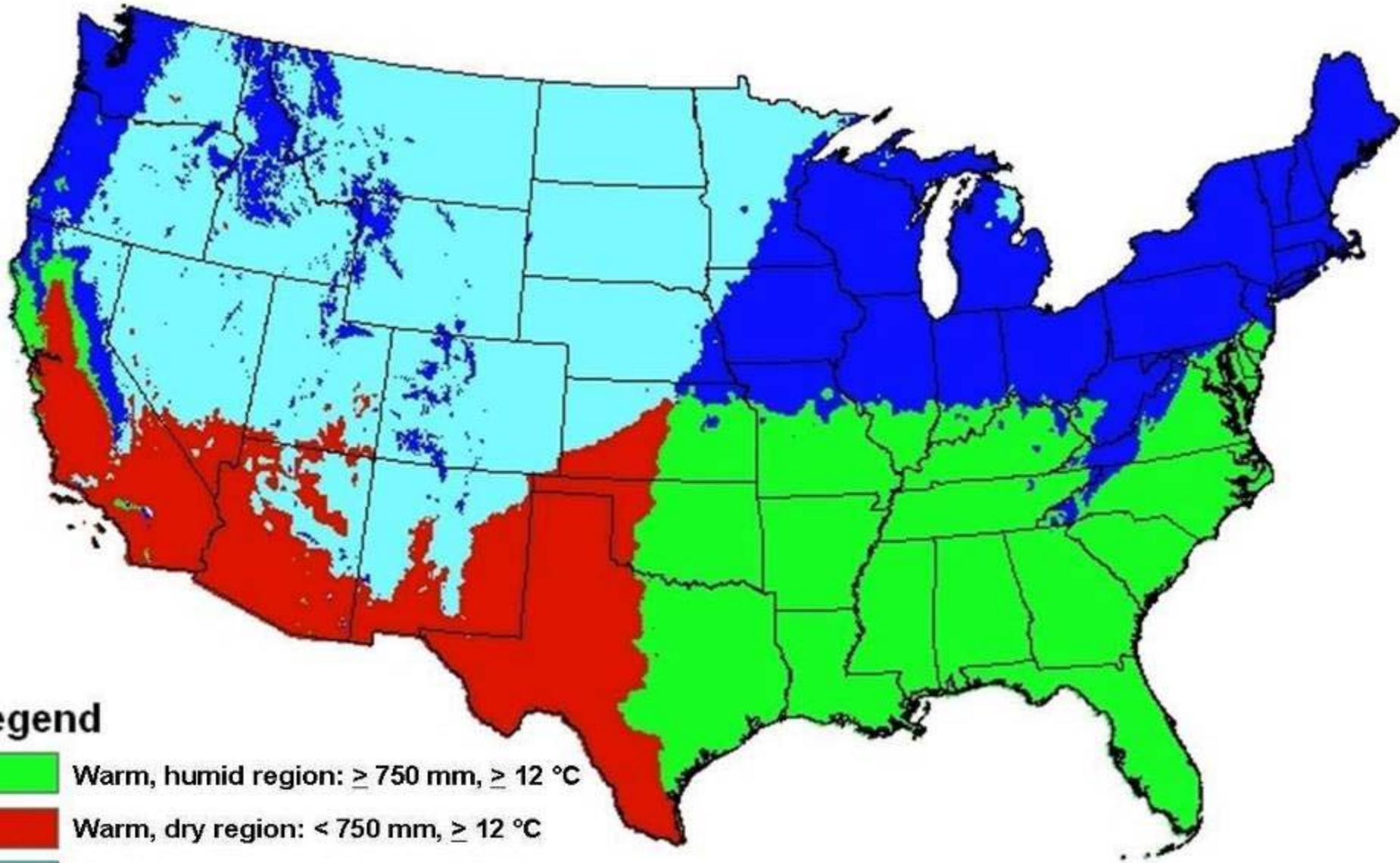


Where could integrated crop / livestock systems be developed?

- **Everywhere**
- **Nowhere**
- **Depends...**



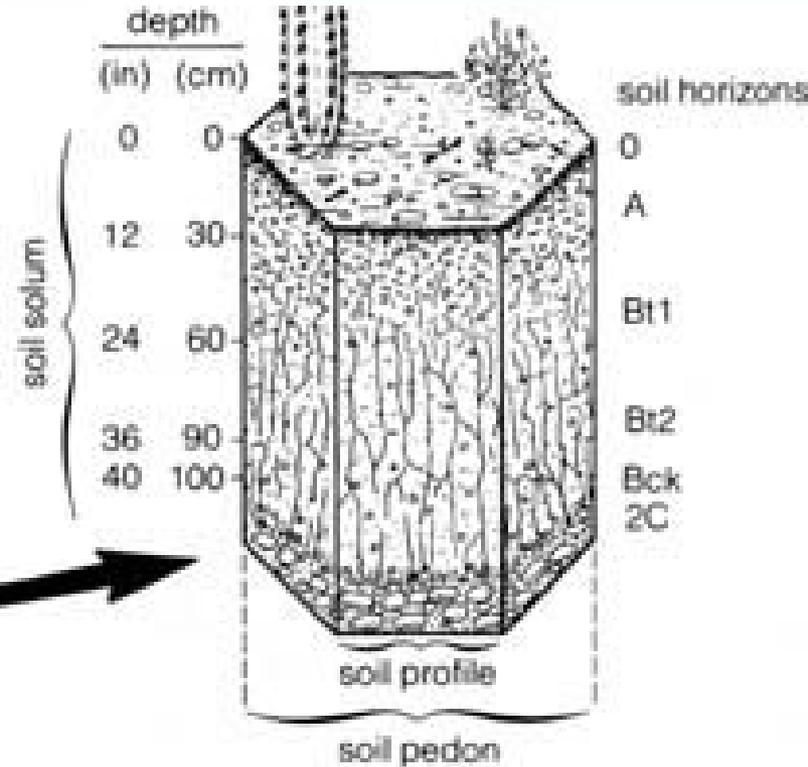
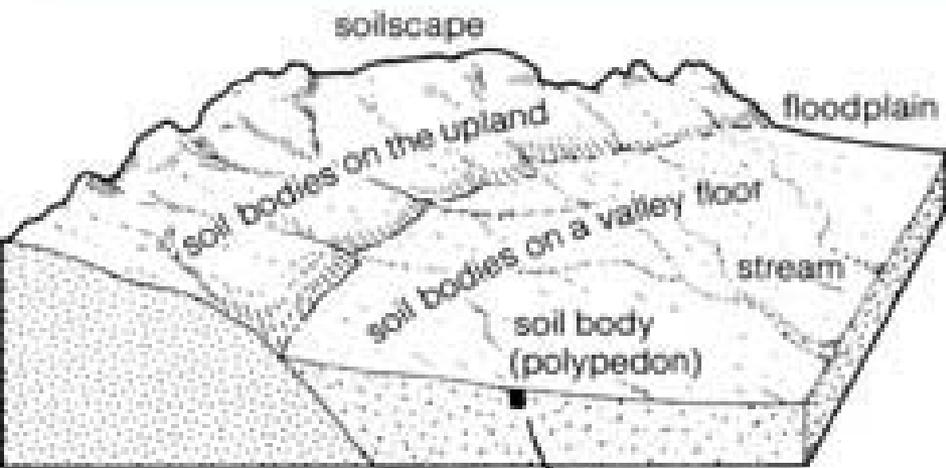
...environmental considerations



Legend

-  Warm, humid region: ≥ 750 mm, ≥ 12 °C
-  Warm, dry region: < 750 mm, ≥ 12 °C
-  Cool, dry region: < 750 mm, < 12 °C
-  Cool, humid region: ≥ 750 mm, < 12 °C

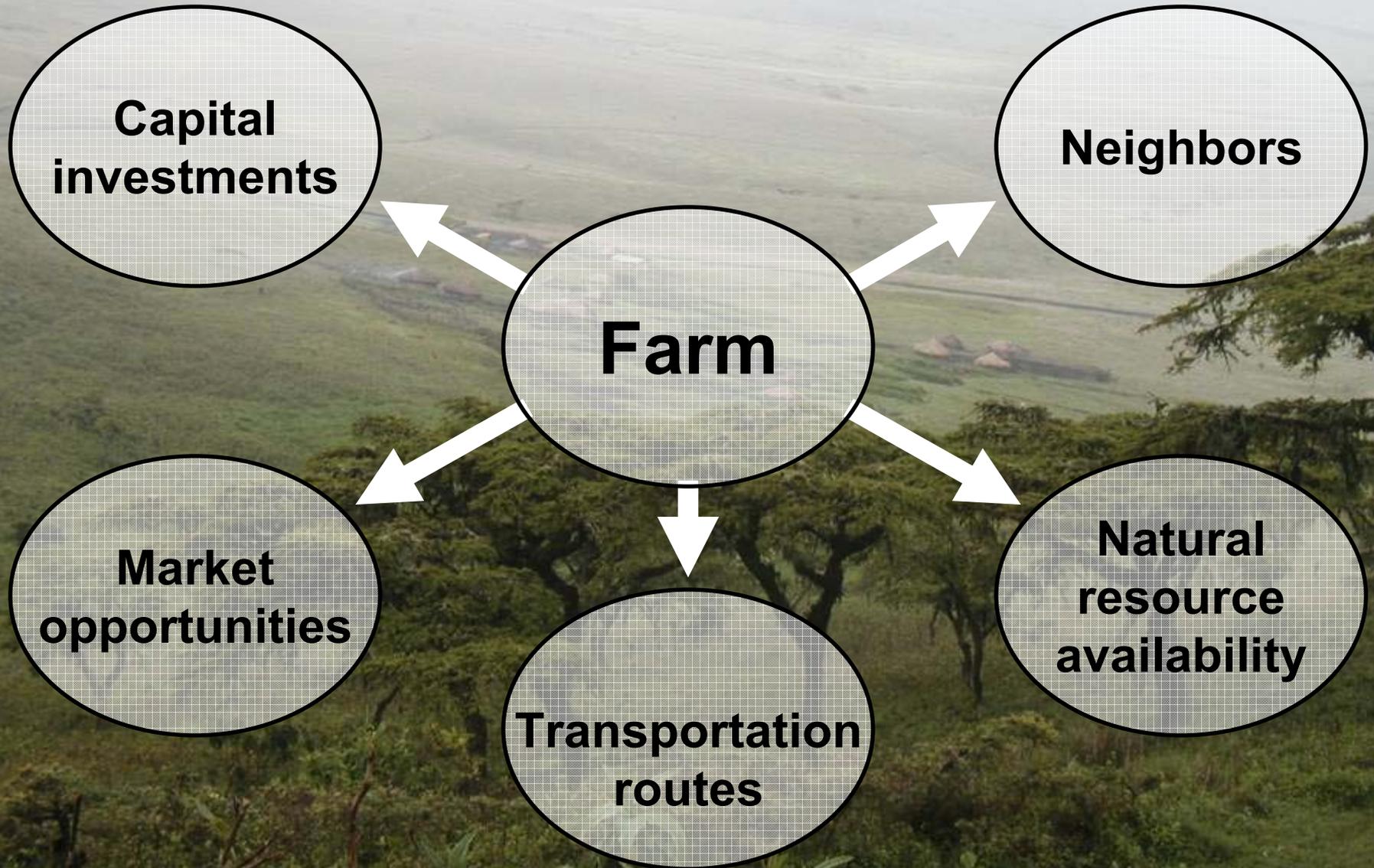
...soil / landscape considerations



<http://southwest.library.arizona.edu/azso/fig040.jpg>
Credit: Paul Mirocha



...socio-cultural considerations



When could integrated systems be appropriate?

- **Never**
- **Always**
- **Depends...**



...threat of litigation



Source: Sharpley, Herron, West, Daniel (2009) Outcomes of phosphorus-based nutrient management in the Eucha-Spavinaw Watershed. In: Farming with Grass, p. 192-204. SWCS, Ankeny IA, www.swcs.org

...threat of animal health decline



Dick Thompson
Boone County, Iowa
Practical Farmers of Iowa
www.practicalfarmers.org



Sharon and Dick Thompson accept an environmental excellence award in 2002 from Iowa Governor Tom Vilsack.

...market opportunities more palatable



Photo: Otter Creek Farm



Photo: Grass Point Farms



Photo: CIAS



...Mother Nature shares hints



...Mother Nature shares hints



www.sustainableranching.com

...economic conditions right



...economic conditions right



How could integrated systems look?



Grazing of winter cover crops following grain and fiber crops
in the southeastern USA

What are best species – individually and in mixtures?

How could integrated systems look?

Sod-based rotations of perennial pastures with several years of grain and/or fiber crops

Are historical rotations applicable or do improved tillage / rotation systems need to be developed for Midwest, Great Plains, Southeast, Northeast, etc.



<http://www.ers.usda.gov/AmberWaves/June06/Features/images/feature2.jpg>

Creatas

How could integrated systems look?

Mixed forages...



**Gabe Brown (Brown's Gelbvieh Ranch)
Burleigh County, North Dakota**

www.sustainable ranching.com/Cover%20crop%20cocktail.jpg



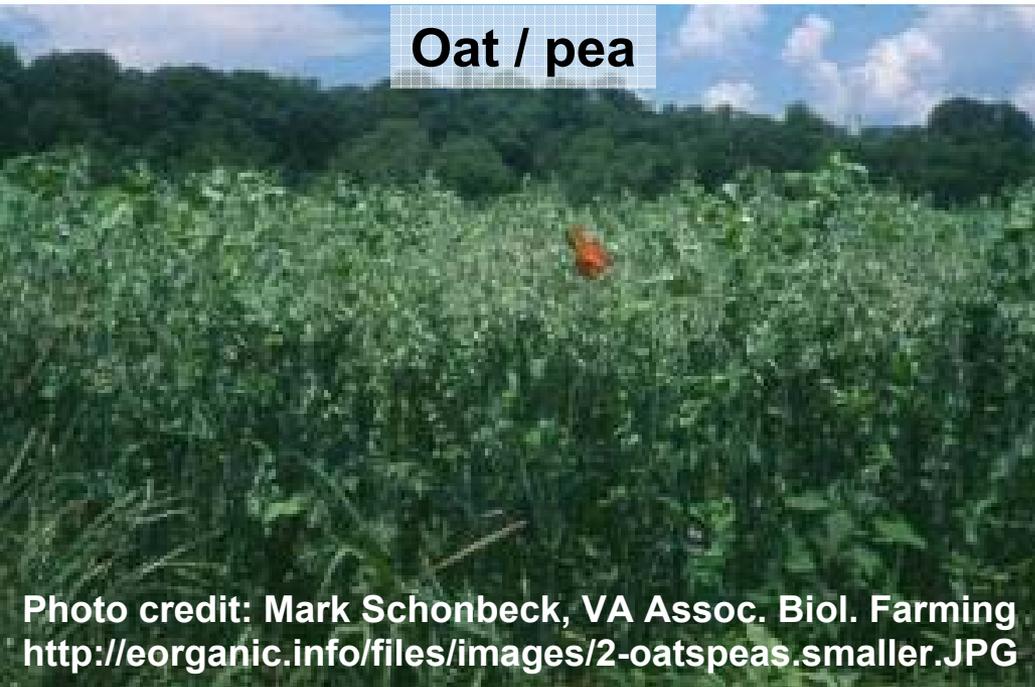
**Steve Groff (Cedar Meadow Farm)
Lancaster County, Pennsylvania**

<http://newfarm.rodaleinstitute.org/features/2005/1105/winterradish/images/cloverradish.jpg>



How could integrated systems look?

Mixed forages...

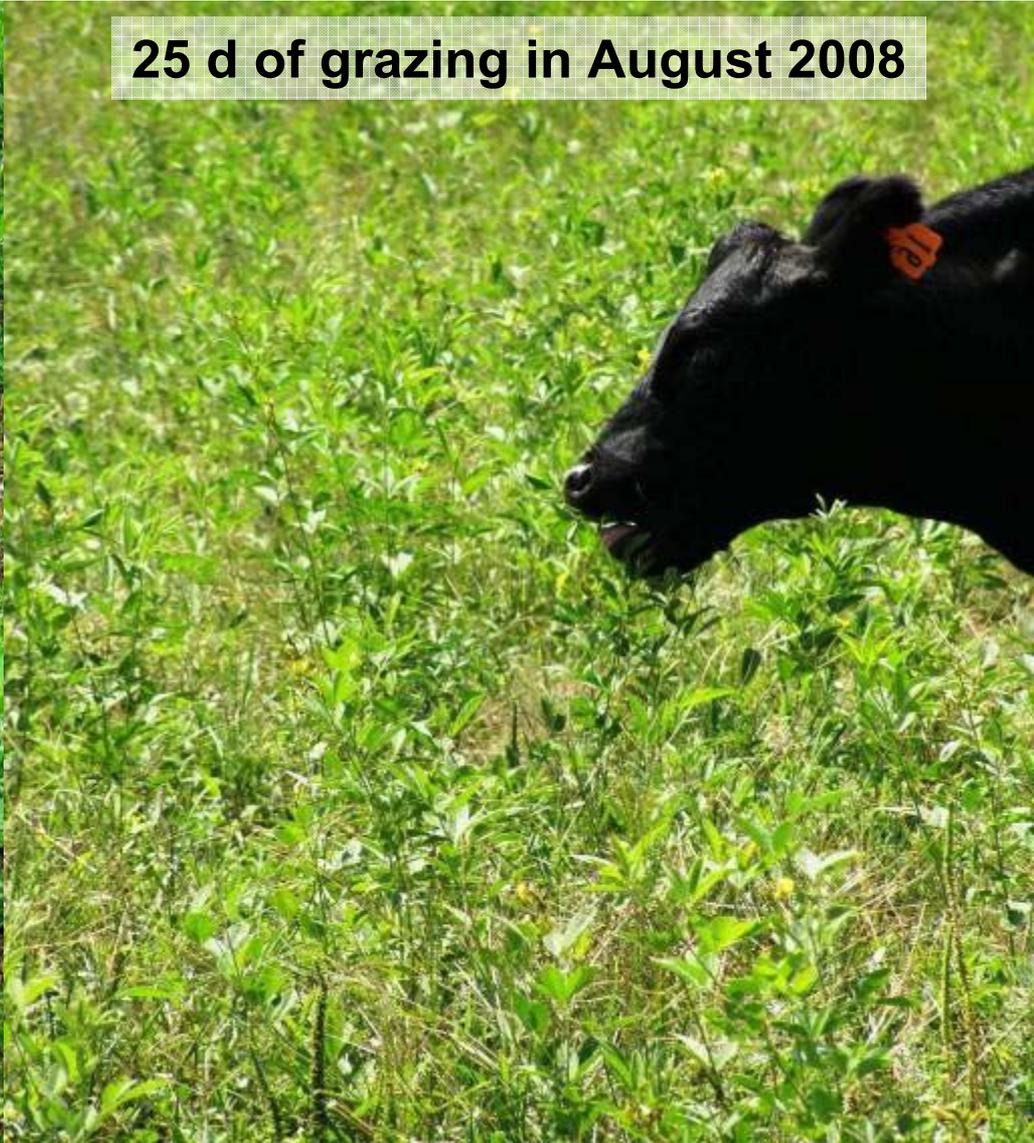


How could integrated systems look?

Replacement of bare fallow in Oklahoma (Srinivas Rao)



'GA-2' pigeon pea
60 days after planting
following wheat harvest

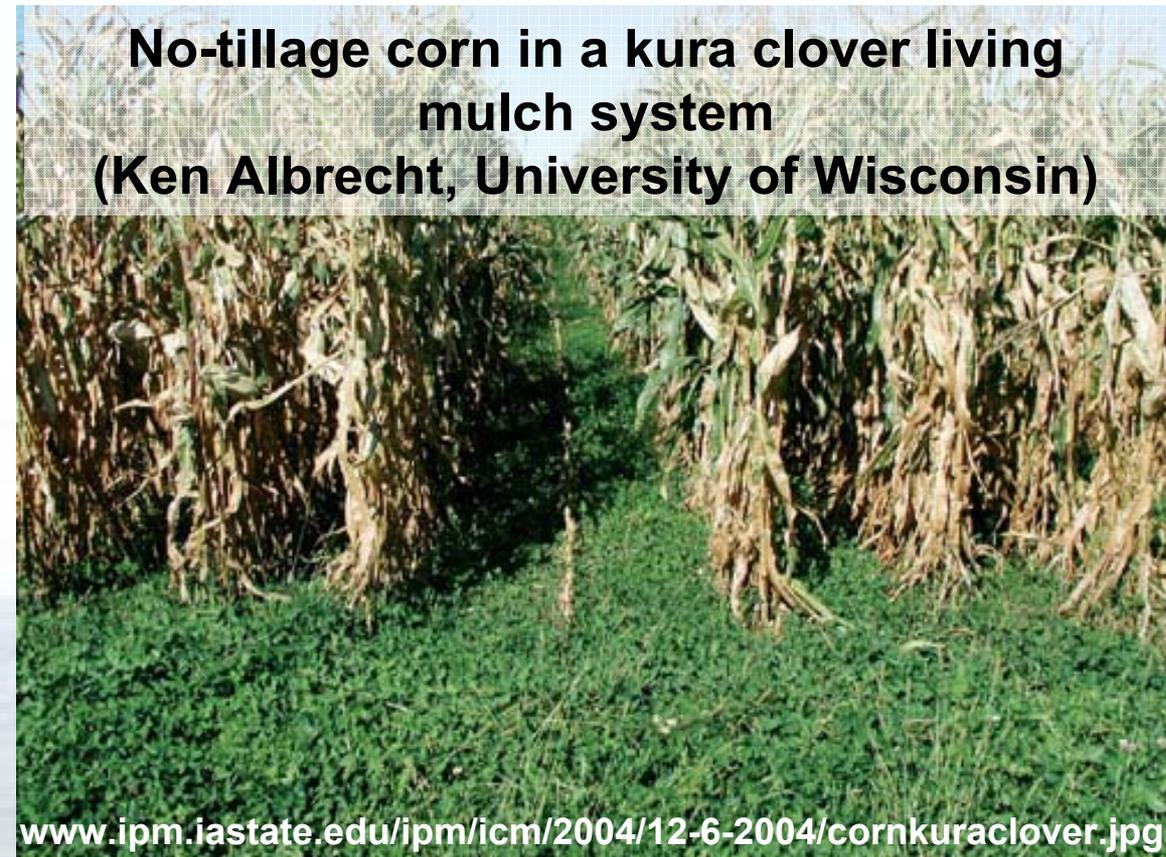


25 d of grazing in August 2008

How could integrated systems look?

Interseeding in grain crops...

No-tillage corn in a kura clover living mulch system
(Ken Albrecht, University of Wisconsin)



Black medic growing under flax (left) and oat (right).

A self-seeding legume growing under flax.

<http://www.umanitoba.ca/outreach/naturalagriculture/index.html>

How could integrated systems look?

Manure application...



How could integrated systems look?

Pasture raised animals...



Grass-Fed Beef



Pastured Poultry



Pastured Pork

How could integrated systems look?

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)



Drilling corn into standing ryegrass of tree alleys

How could integrated systems look?

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)



Fertilizing corn emerging through desiccated cover crop

How could integrated systems look?

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)

Cattle introduced onto corn at late roasting stage



How could integrated systems look?

Integrated crop / livestock / woodlot in Mississippi (Glover Triplett)



Works on steep areas that would not be considered usable because of erosion potential or in areas that are too small to be profitably farmed in conventional fashion

What about current issues of concern?

Profitability

Corn	Disk tillage	No tillage	Disk tillage	No tillage
2005	Ungrazed	Ungrazed	Grazed	Grazed
	\$/acre	\$/acre	\$/acre	\$/acre
←Variable	164	175	234	245
←Fixed	100	100	100	100
Crop→	288	383	333	298
Cattle→	0	0	158	244
Return	24	108	157	197

What about current issues of concern?

Profitability

Sustainability

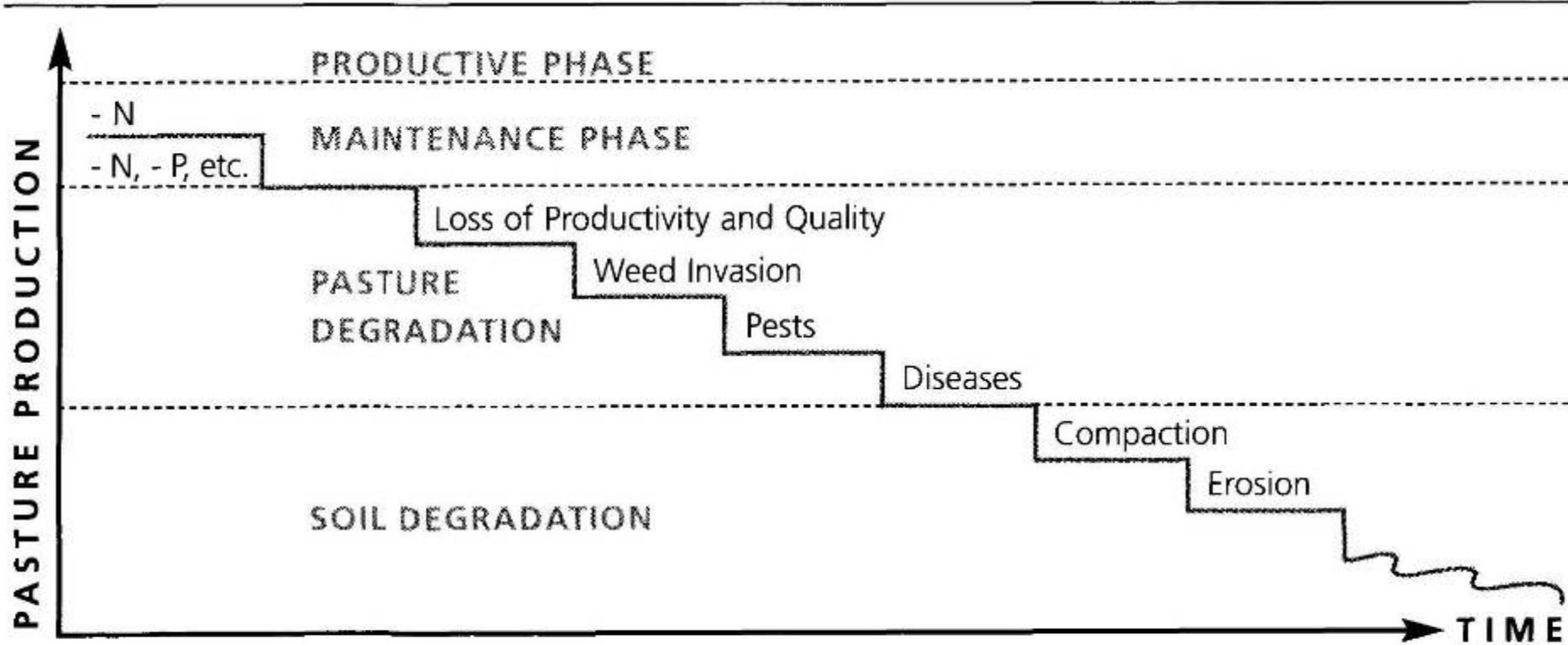
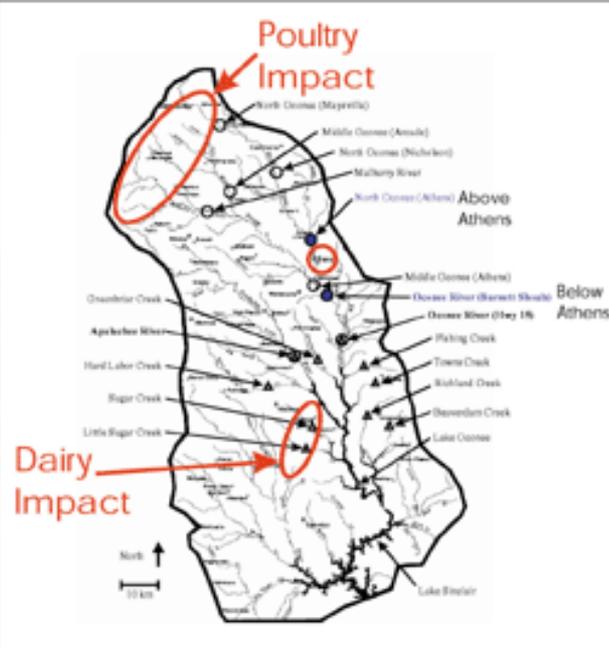


FIGURE 5: Schematic representation of the soil degradation process

Source: Macedo (1999) in Vilela *et al.* (2004).

What about current issues of concern?

Water quality



Nutrient trading



What about current issues of concern?

Soil carbon sequestration



Greenhouse gas emissions



USDA-ARS GRACEnet

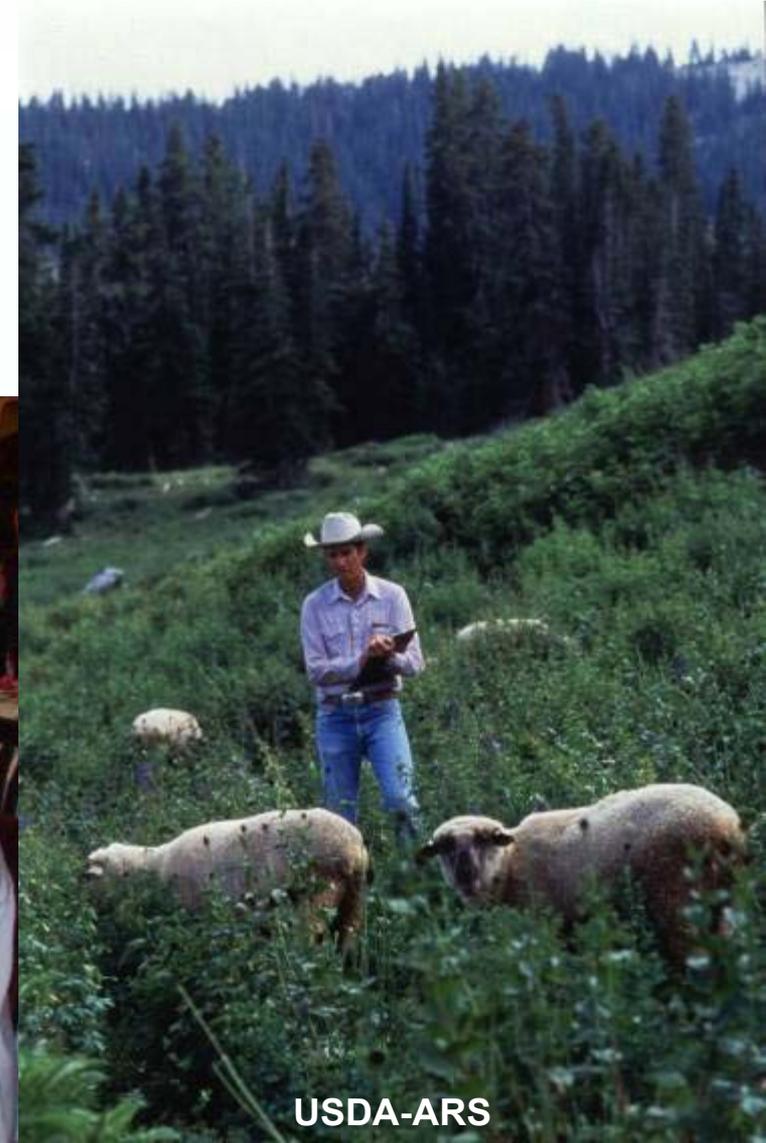
What about current issues of concern?

Healthy food



USDA Supported Programs for Sustainable Agriculture

Scenic landscapes



USDA-ARS



Summary

Integrated crop / livestock systems

Conservation of soil and water resources is a necessity in our world of ever-changing and competing human activities

Meeting the food and fiber demands of a growing world population will only become more difficult with competing energy and natural resource commitments

Integration of crops and livestock has great potential to improve resource efficiency of agricultural production around the world

Sod-based crop rotations effectively improve soil and water quality

Cover crops offer unique opportunities to integrate livestock grazing with cropping systems

Some cases of integration have been developed, but much more research is needed to optimize systems within unique local and regional conditions

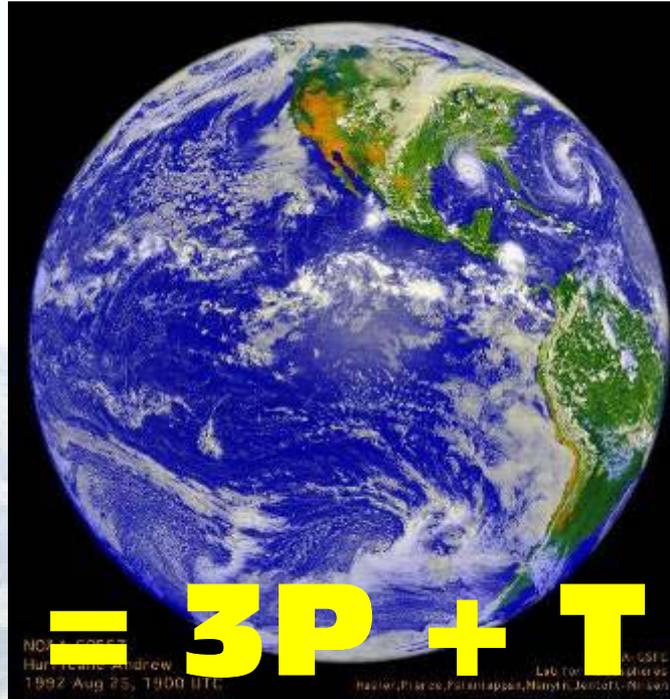
In conclusion

How does (3P + T) translate to a sustainable agriculture? Protection

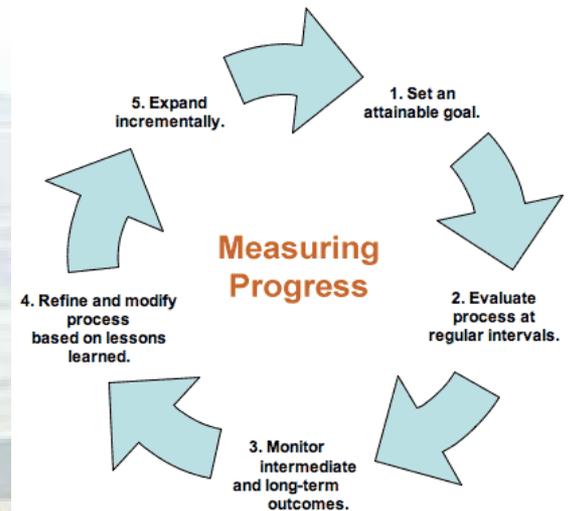
People



Production

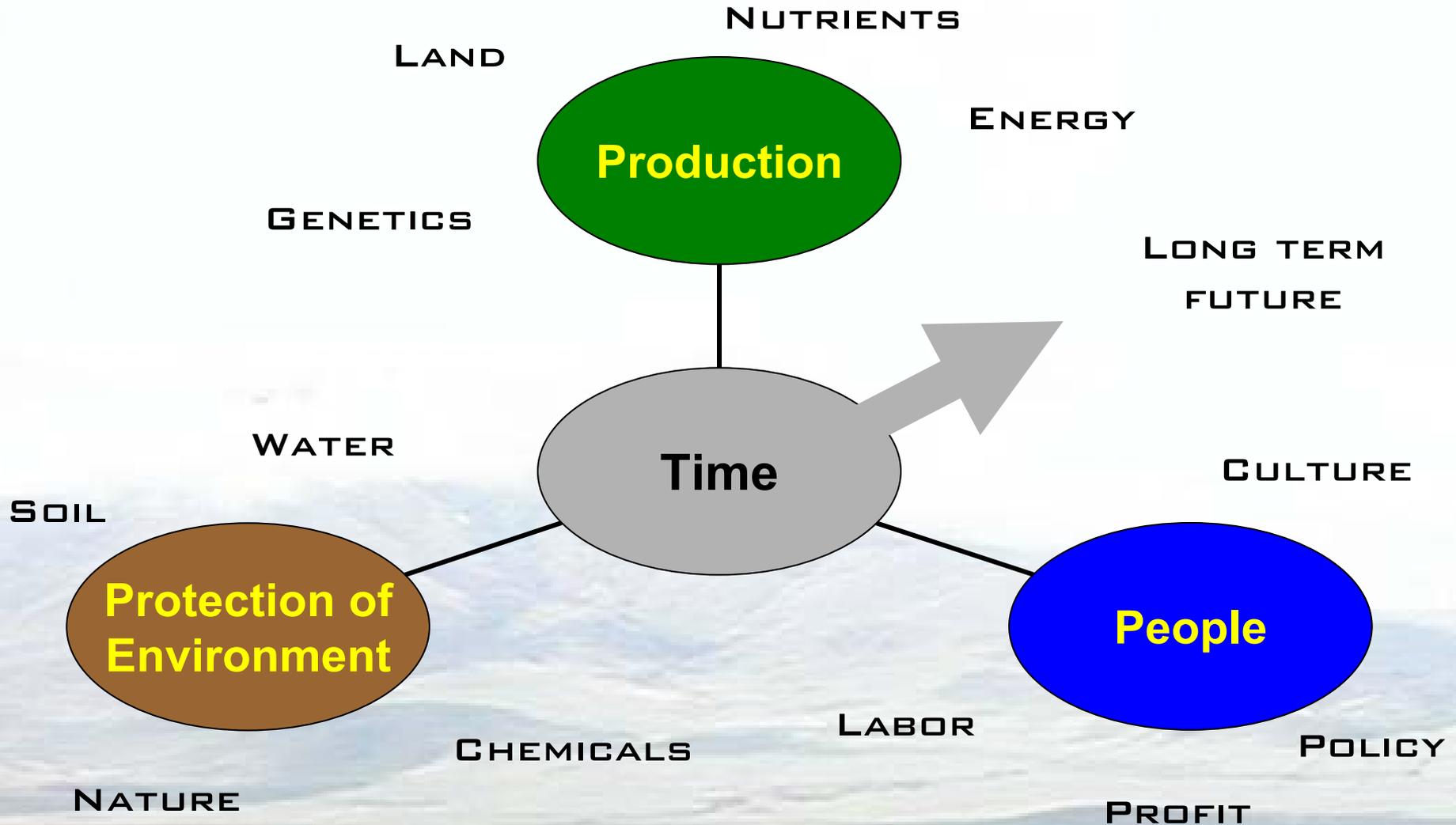


Time



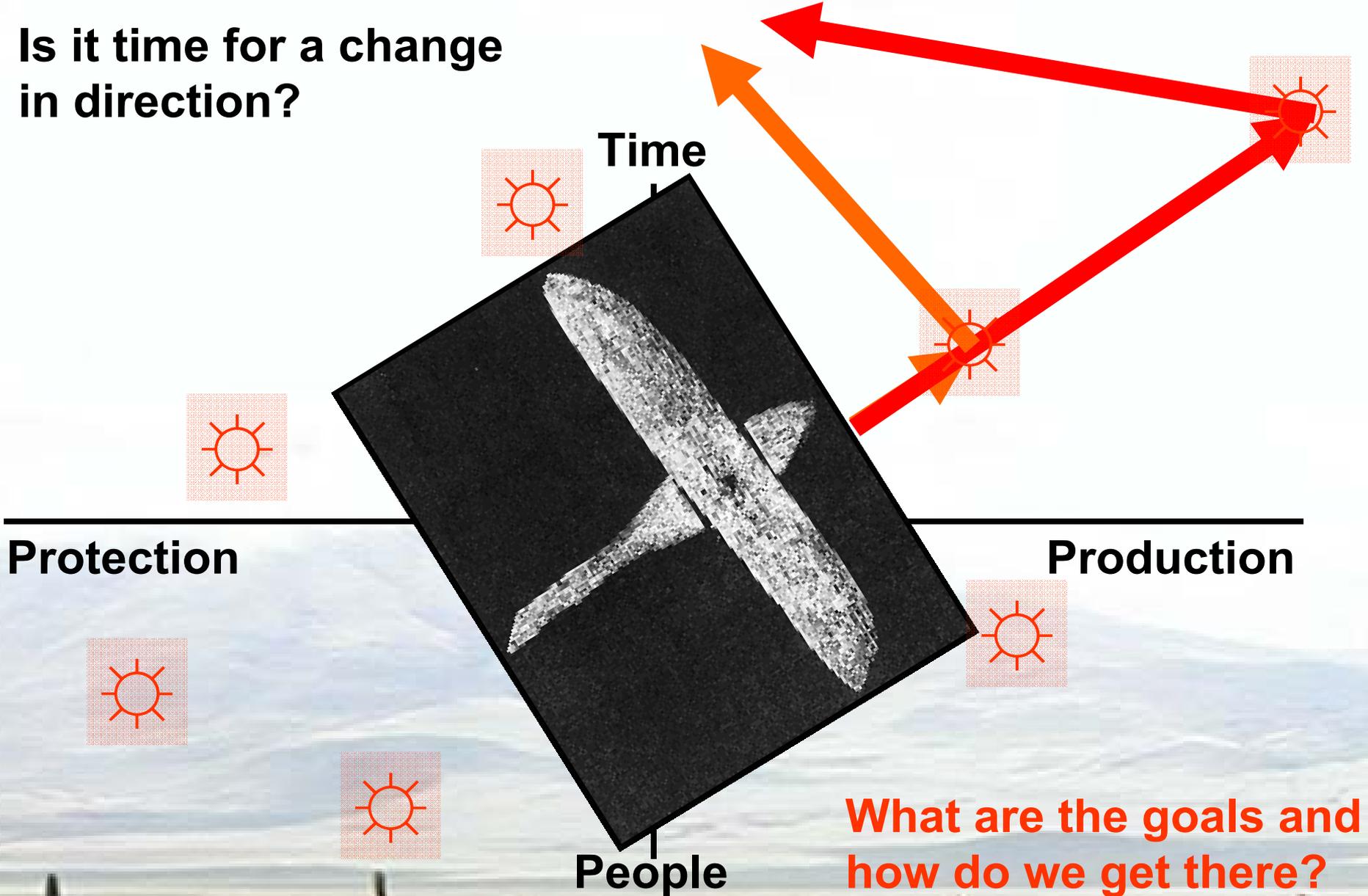
In conclusion

Balance



In conclusion

Is it time for a change in direction?



What are the goals and how do we get there?