

Swidden – Fallow Agriculture



Botany first

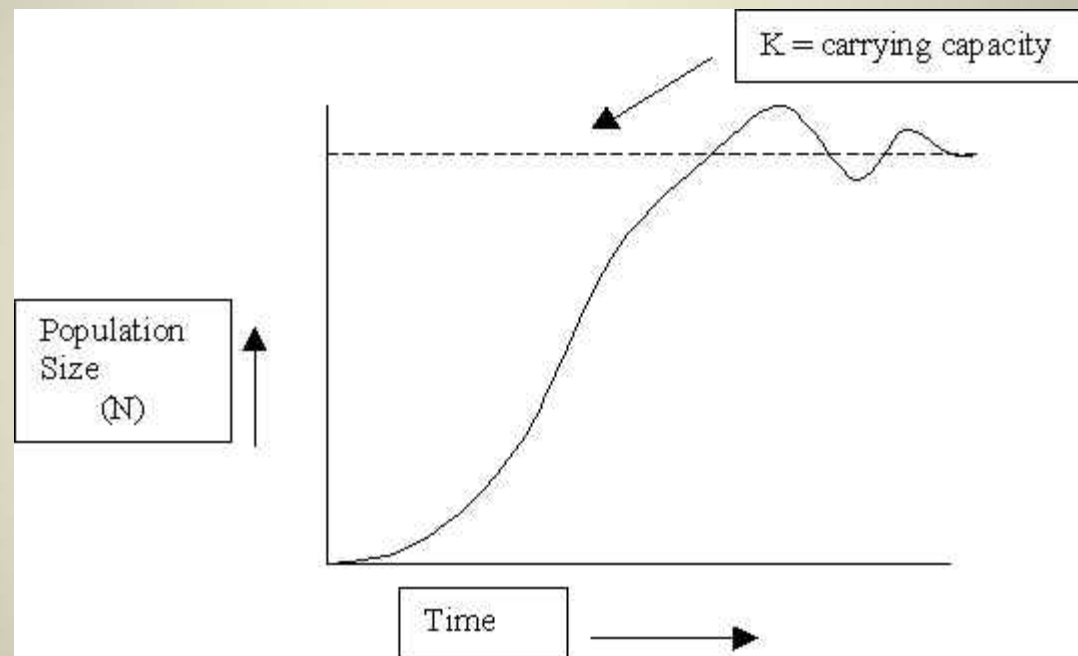


Forest Dynamics

* this is not Chaco Canyon



K strategy



K strategy

Longer lives, larger seeds, ability to withstand adverse conditions, live in specialized habitats, later successional, develop natural toxins and fungicides.



Calvaria major



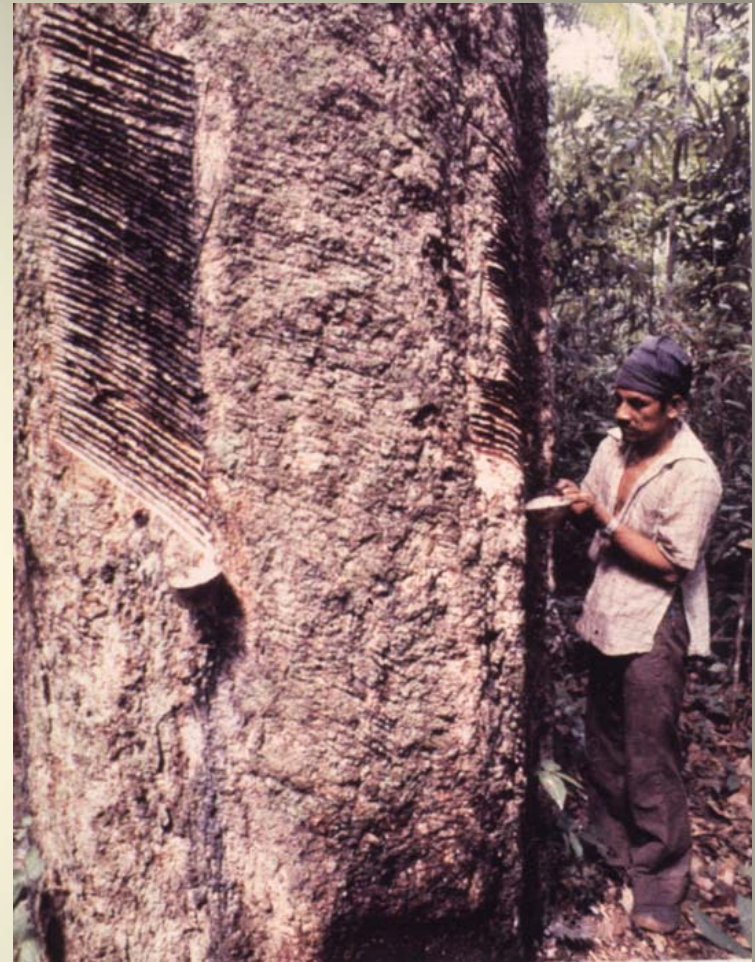
Black Walnut





Frankincense in Ethiopia

These are complicated chemicals.



Rubber in the Amazon





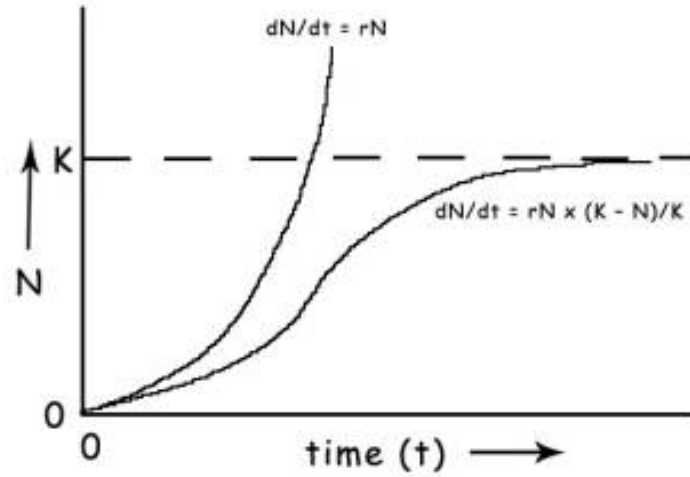
New World pine

Resin, the SE US &
Central America

Impact on plant
growth



r strategy



r strategy

Short lives, many small seeds (sometimes with niche environments for seeds), vegetative reproduction, early successional species

In tropical forests r strategy plants may have disposable leaves



r strategy – Aspen seeds, none of these will survive



No plant is purely r or K strategy

1. More likely to root or stump sprout when young



No plant is purely r or K strategy

1. More likely to root or stump sprout when young
2. Shift energy to seed production when wounded or dying



No plant is purely r or K strategy

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3. Competition in growth, plants grow to eliminate competition



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4. Most species have some form way to deter insects



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1. More likely to root or stump sprout when young
2. Shift energy to seed production when wounded or dying
3. Competition in growth, plants grow to eliminate competition
4. Most species have some form way to deter insects
5. Species diversity is "kind of" avoidance strategy





Mass flowering and fruiting

SE Asia, 4 months, once per 5-10 years, light fruiting other years, carpenter bees and thrips, overwhelm animals

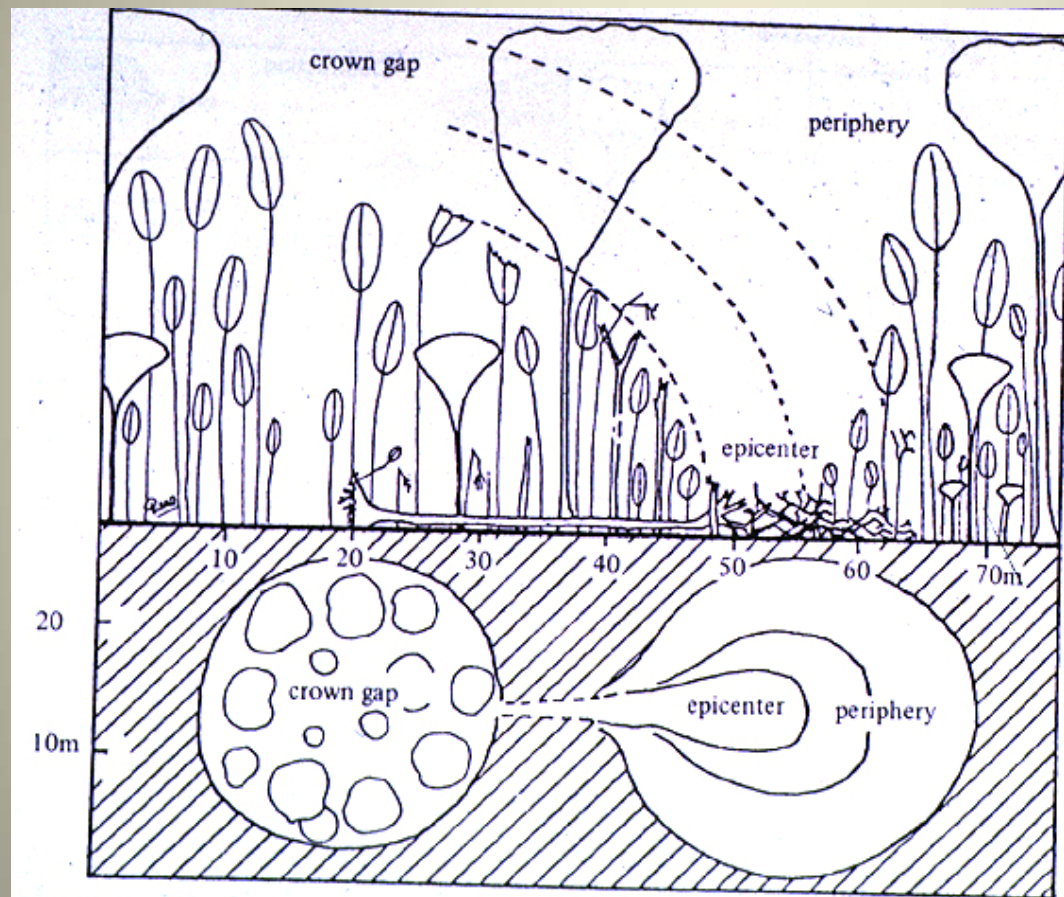


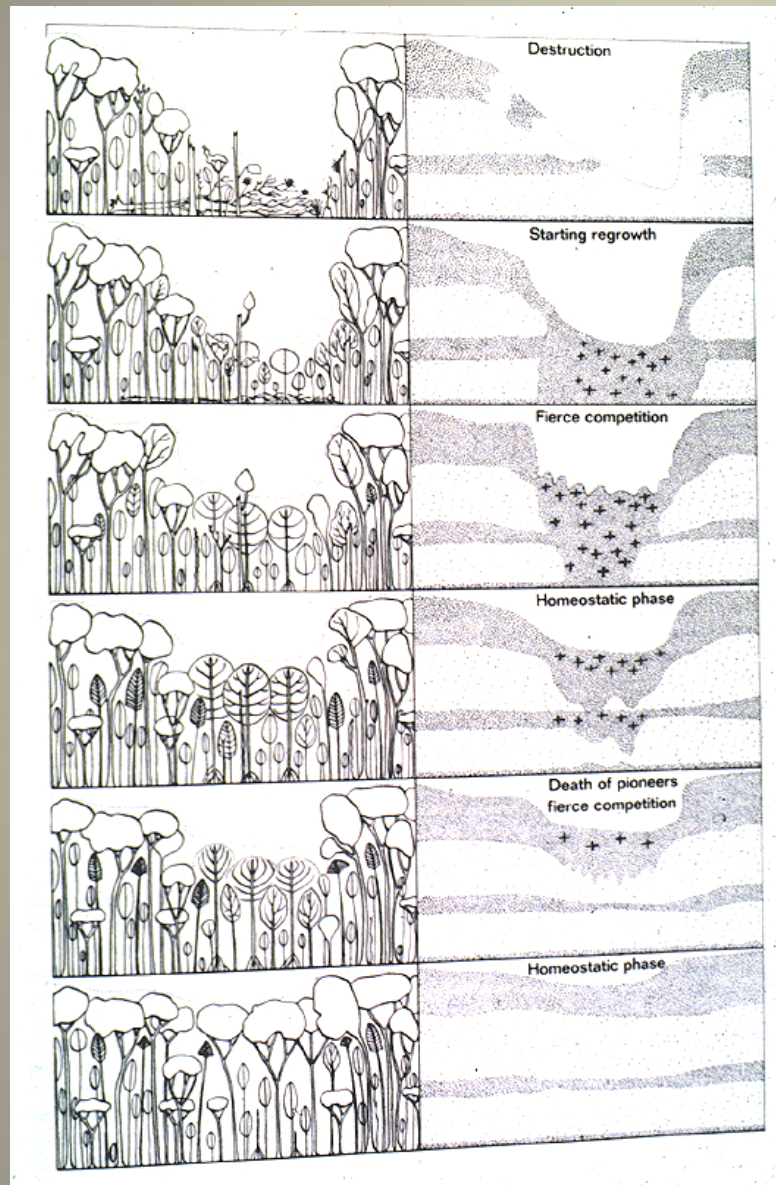


Lone tree flowering



A chablis – gap dynamics, small vs. large gaps





Gap fill



Human Dimension: Using gaps and butterfly harvest in Papua New Guinea



Understanding the basics of rain forest ecology allows us to understand how and why swidden fallow agriculture works.



Quick introduction – how do people use tropical forests (not just rainforests)

1. Habitat for people.

- a. Hunting / gathering
- b. Proto-agriculture or proto-horticulture.



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(not just rainforests)

1. Habitat for people.
2. Land clearing for agriculture



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1. Habitat for people.
2. Land clearing for agriculture
3. Grazing for cattle and other livestock (arid)



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3. Grazing for cattle and other livestock
4. Fuelwood



Quick introduction – how do people use tropical forests (not just rainforests)

1. Habitat for people.
2. Land clearing for agriculture
3. Grazing for cattle and other livestock
4. Fuelwood
5. Non-timber products



Who lives in the rainforest?



Wilfredo Lam, The Jungle, Cuban, 1943



Who lives in the rainforest?



Elmo Lincoln & Enid Markey in 1918 Tarzan



Who lives in the rainforest?



Henri Rousseau, "The Dream", 1910



A more accurate depiction.



John La Farge, "Afterglow, Tautira river," 1891

... in search of protein



Who lives in the rainforest?

The Efe, hunter – gatherers.

Clothes are often one of the first modern acquisitions.



Diet gathered by Efe

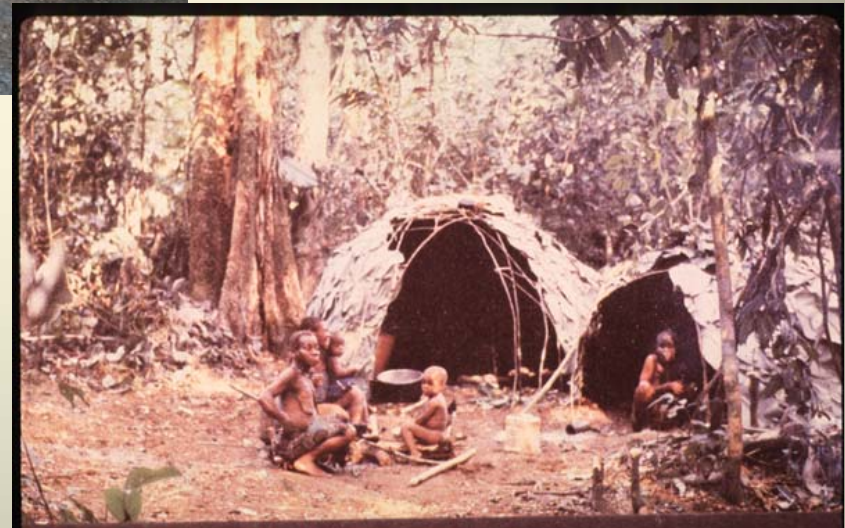
25% hunting
15% honey

60% plants





No mortgage problem here



Mutual (sort of) trade with the Lese, swidden-fallow farmers



Lese swidden fallow.

1. Men Clear the Fields

2 to 50 ha

Land cleared 25 to 60 years ago

- a. Early successional
- b. Softer wood – poor tools
- c. No weeds, seed bank function gone

Mimics a natural gap in the forest



Lese swidden fallow.

1. Men Clear the Fields

Modern life intrudes.

A woman clears the field.



Lese swidden fallow.

2. Women plant manioc (cassava), plantains and bananas.

- a. Vegetative
- b. Starch in diet
- c. Planted under felled forest debris – protects soil



Lese swidden fallow.

2. Women plant manioc (cassava), plantains and bananas.

- a. Vegetative
- b. Starch in diet
- c. Planted under felled forest debris – protects soil

Mimics the crown end of a chablis with the debris remaining over the forest.



Lese swidden fallow.

3. Men lightly burn fields.

Opens stand slightly, but the early crops now provide soil protection

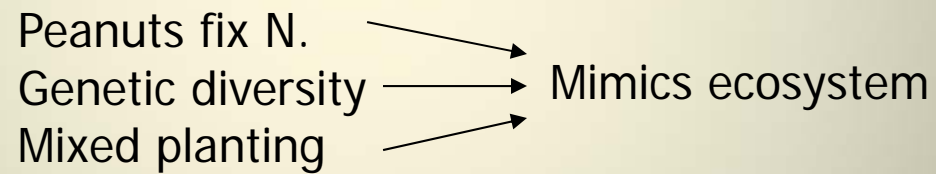
Adds soil nutrients: N and S volatilize.

Remaining cations in ash are nutrients



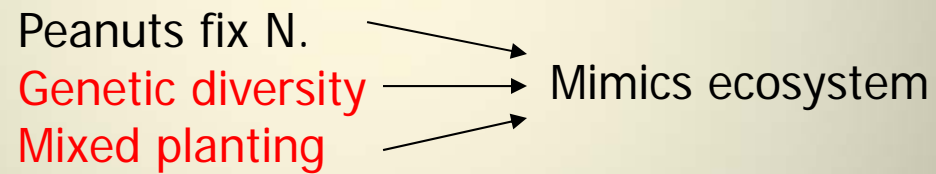
Lese swidden fallow.

4. Women plant peanuts, corn, squash, sugar cane, other plants.



Lese swidden fallow.

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Tangent: Plant and Genetic Diversity.



Maize from one farmer in Mexico

... matching maize variety to environment / especially soil type



Tangent: Plant and Genetic Diversity.



Rice in the Peruvian Amazon

... when you move plants do you move pests?



Tangent: Plant and Genetic Diversity.



Bananas (*Musa* spp.) – 70+ species including plantains
... photo on right is *Musa zebrina*.



Tangent: Plant and Genetic Diversity.



Cocoa / Cacao



Tangent: Plant and Genetic Diversity.



Breadfruit



Tangent: Plant and Genetic Diversity.



Mutiny on the Bounty: Starring Breadfruit.

By Employee(s) of Metro-Goldwyn-Meyer -

<http://www.doctormacro.com/Movie%20Summaries/M/Mutiny%20on%20the%20Bounty%20%281935%29.htm>,

Public Domain, <https://commons.wikimedia.org/w/index.php?curid=17878438>



Tangent: Plant and Genetic Diversity.



Dr. Diane Ragone, National Tropical Botanical Garden,
Director of the Breadfruit Institute.



Tangent: Plant and Genetic Diversity.



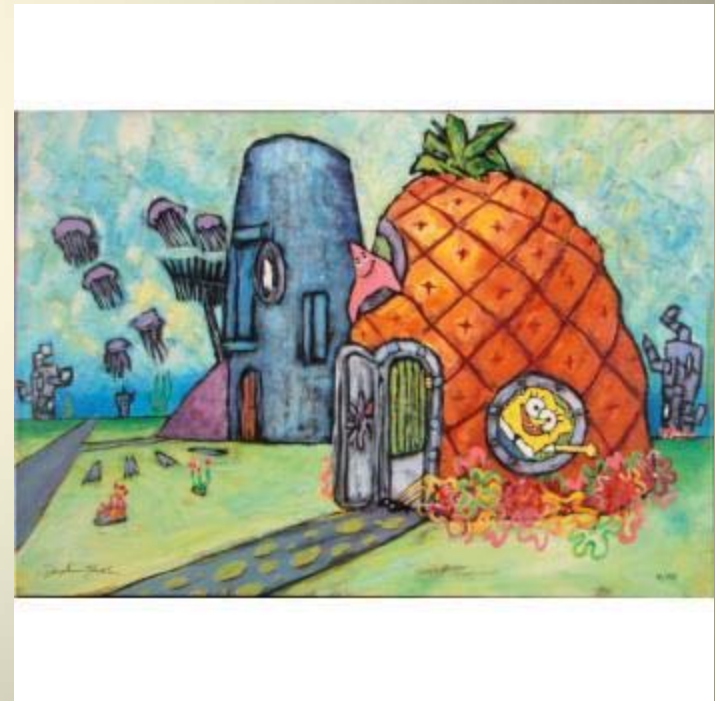
Papaya



Tangent: Plant and Genetic Diversity.



Pineapple



Tangent: Plant and Genetic Diversity.



Manioc / Cassava



Tangent: Plant and Genetic Diversity.

Mixed Cropping



Lese swidden fallow.

5. Women weed/tend the fields, men drink libondo palm wine .



Lese swidden fallow.

6. Women continuous intensive harvest over 15 months.

The second planting crops are earlier maturing and are harvested first.



Lese swidden fallow.

7. Less intensive harvest to 3 years.



Lese swidden fallow.

8. Minimal harvest for many years.

Efe come in and hunt in the later years.



Waadoni



No word for work.

Partial cutting, burn, plant, final cut.

Like the Lese, women do most of the gardening



Yamomami



Men, widows, and “abnormal” women
are the gardeners,



Secoya tribe, a *Combretum* vine is used to treat heart disease.



Heart Disease?



Heart Disease?



Kaplan et al. (2017). Coronary atherosclerosis in indigenous South American Tsimane: a cross-sectional cohort study. *Lancet*, 389 (10080):1730–1739.

Background

Conventional coronary artery disease risk factors might potentially explain at least 90% of the attributable risk of coronary artery disease. To better understand the association between the pre-industrial lifestyle and low prevalence of coronary artery disease risk factors, we examined the Tsimane, a Bolivian population living a subsistence lifestyle of hunting, gathering, fishing, and farming with few cardiovascular risk factors, but high infectious inflammatory burden.



Kaplan et al. (2017). Coronary atherosclerosis in indigenous South American Tsimane: a cross-sectional cohort study. *Lancet*, 389 (10080):1730–1739.

Interpretation

Despite a high infectious inflammatory burden, the Tsimane, a forager-horticulturalist population of the Bolivian Amazon with few coronary artery disease risk factors, have the lowest reported levels of coronary artery disease of any population recorded to date.

These findings suggest that coronary atherosclerosis can be avoided in most people by achieving a lifetime with very low LDL, low blood pressure, low glucose, normal body-mass index, no smoking, and plenty of physical activity. The relative contributions of each are still to be determined.



Heart Disease?



Also, the Tsimane have been studied for personality traits and family size and for musical preferences.



The musical preference study contrasted the Tsimane views of consonance and dissonance with the WEIRD view of consonance and dissonance.

WEIRD = Western, Educated, Industrialized, Rich, and Democratic.





Yoco vine – contains caffeine, an alkaloid

Alkaloids are “expensive” to manufacture as they contain nitrogen





Poison dart frog – a non-timber forest product

There are also neurotoxins from the cambium of some trees.

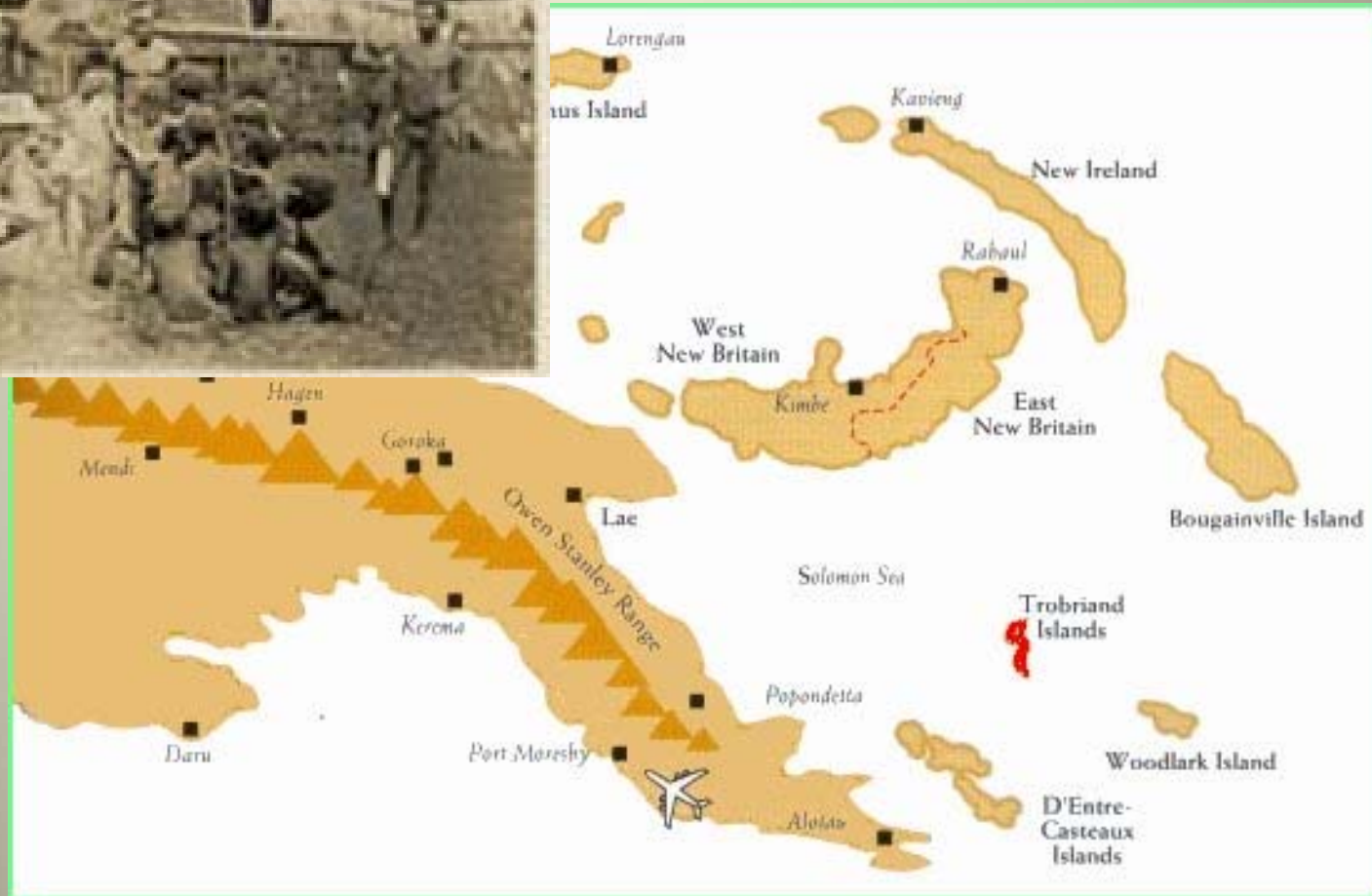




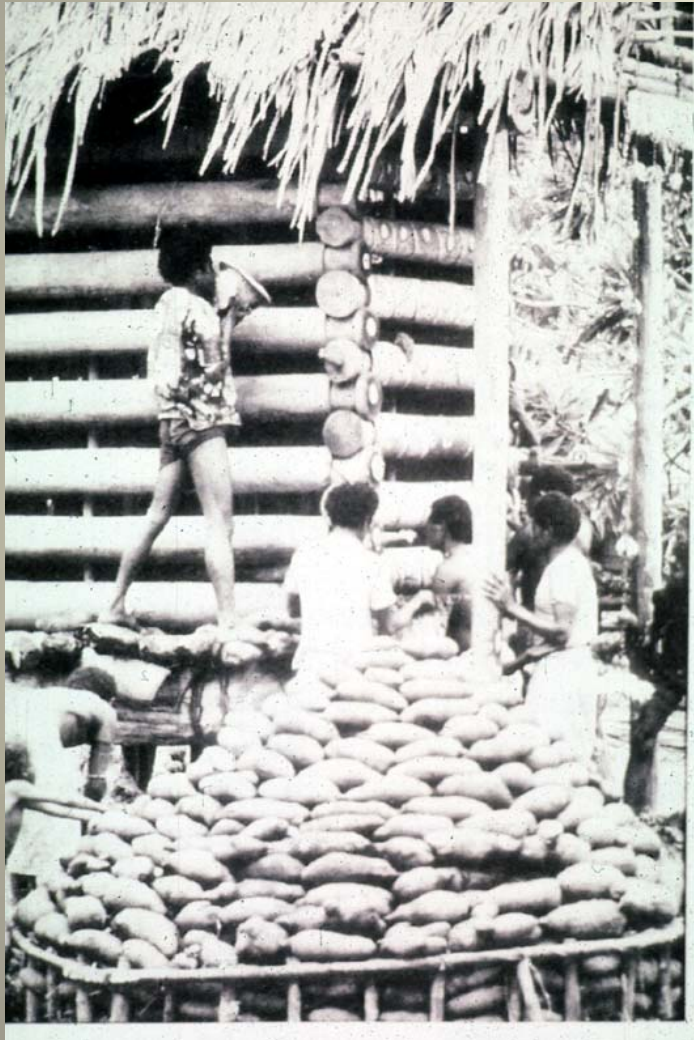
Avon ladies in the Amazon.



Trobriand Islands



Trobriand Islands



Matrilineal ownership &
polygamy



Trobriand Islands



Yams collected and marked for wives.

Men must be good at yam gardening before they can marry.

How do you show you are good at yam gardening?



Trobriand Islands



Yams and diosgenin – Central America

Solanine in Andean potatoes

Yams and marriage proposals



One more swidden-fallow: Thailand



Pa Pae



In the village?



Mango Trees and vitamins



Mango Trees and vitamins

skirts



Mango Trees and vitamins

protein





Spiritual guidance on when to
burn, using a chicken bladder.





Controlled burn.

Indigenous knowledge?





Collecting fuelwood.





Mark individual fields.





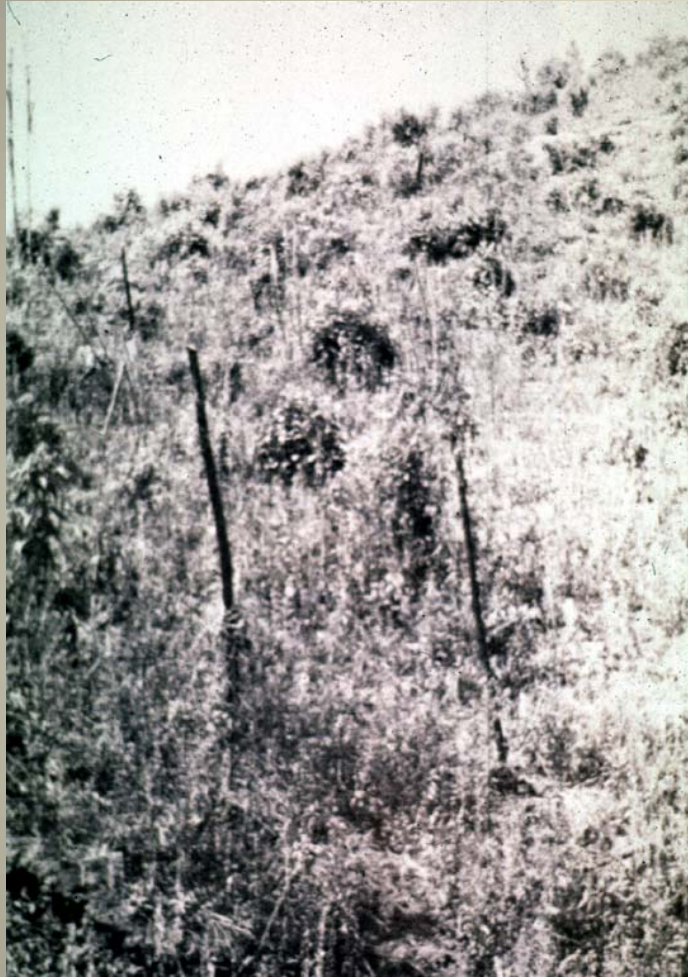
Plant upland rice.





Stumps in rice fields.





Imperata grass after rice harvest.





Carrying *Imperata* grass
home.

Bamboo in the background.





Making *Imperata* shingles.





Roofing. Note division of labor by gender.





Making a split bamboo basket.





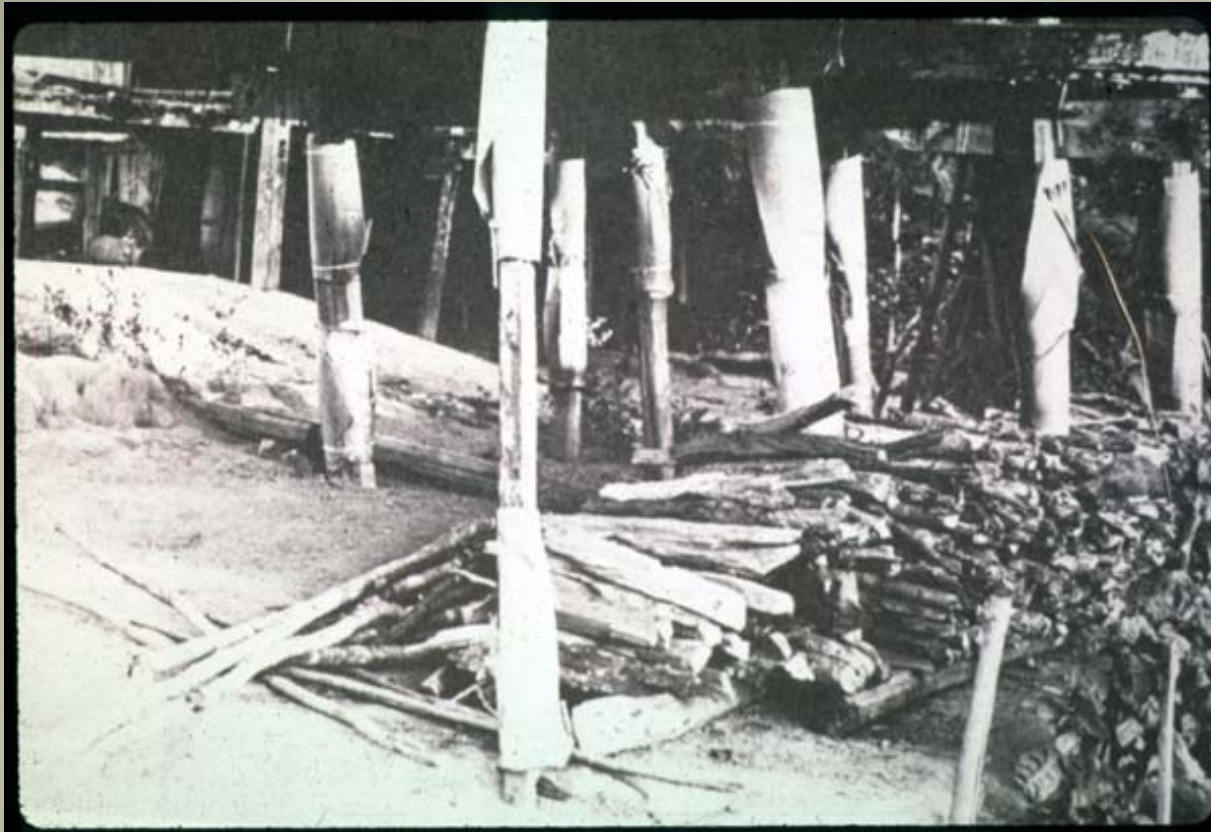
Stream bed use, logs capture erosion, capture soil and allow gardening in good soil with good moisture





Barked chewed for medicinal purposes.





Bamboo leaf sheaths to keep rats out.
Note firewood.





Woman carrying fuelwood.





Women carrying fuelwood.

Nepal.





Woman carrying fuelwood.

Sri Lanka.





Smiling woman carrying fuelwood.

India.

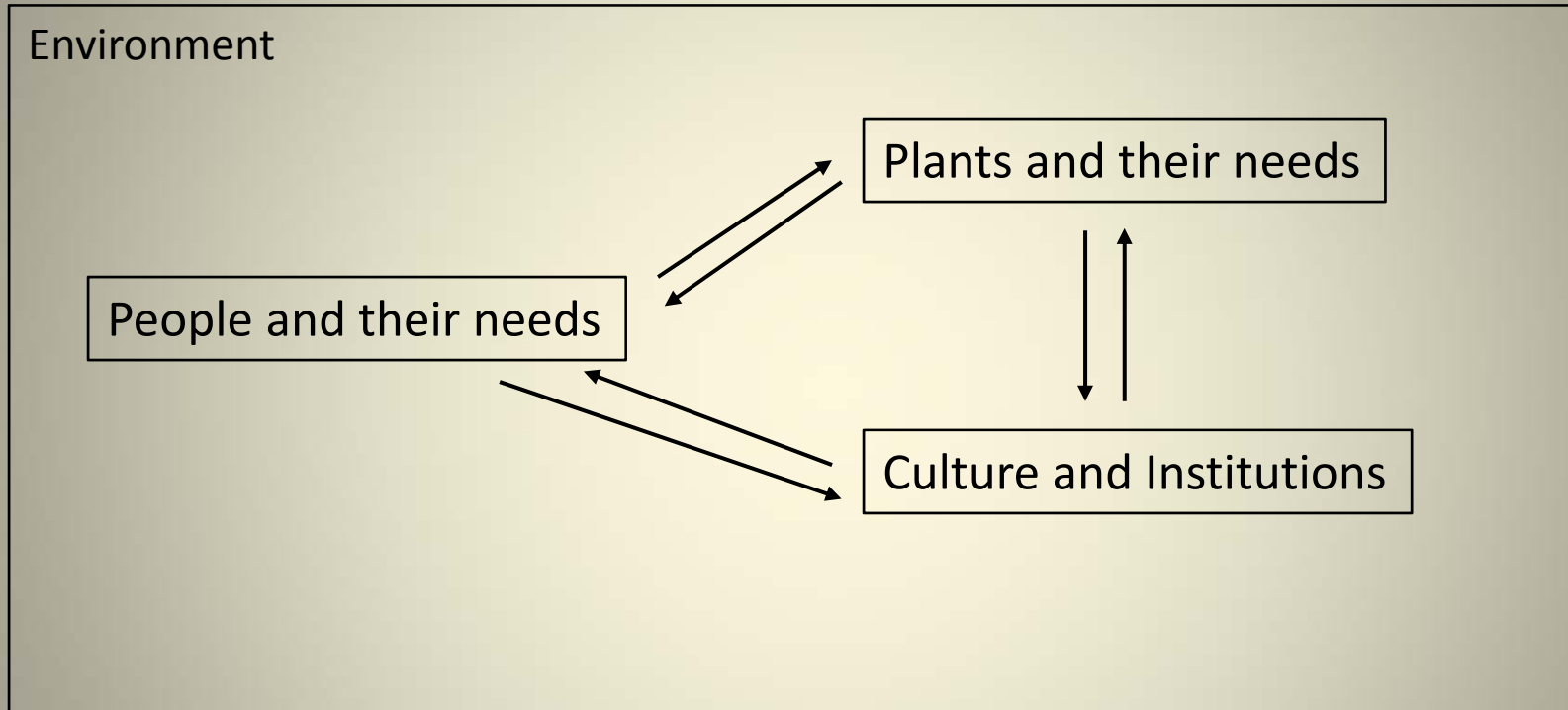




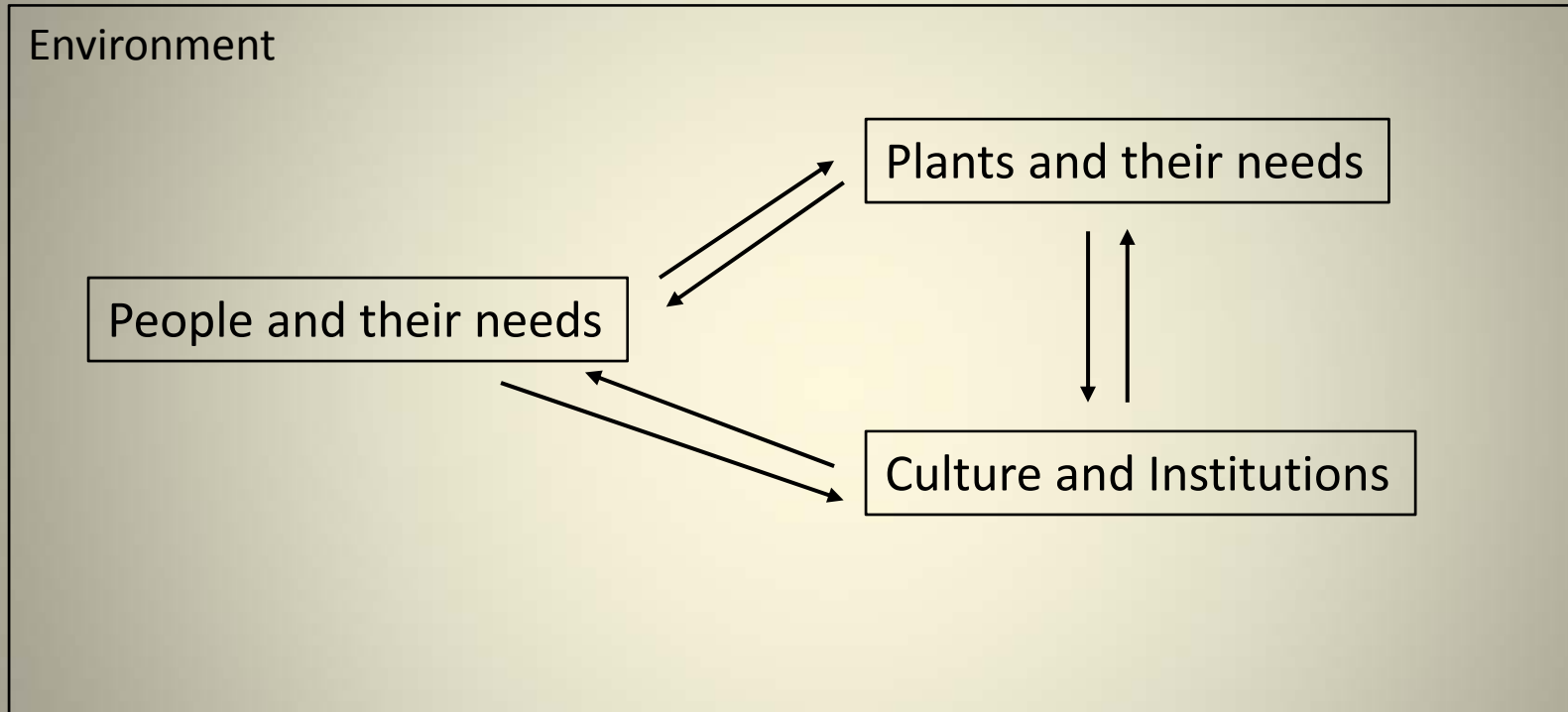
Botswana: man using bicycle to carry a small amount of fuelwood.



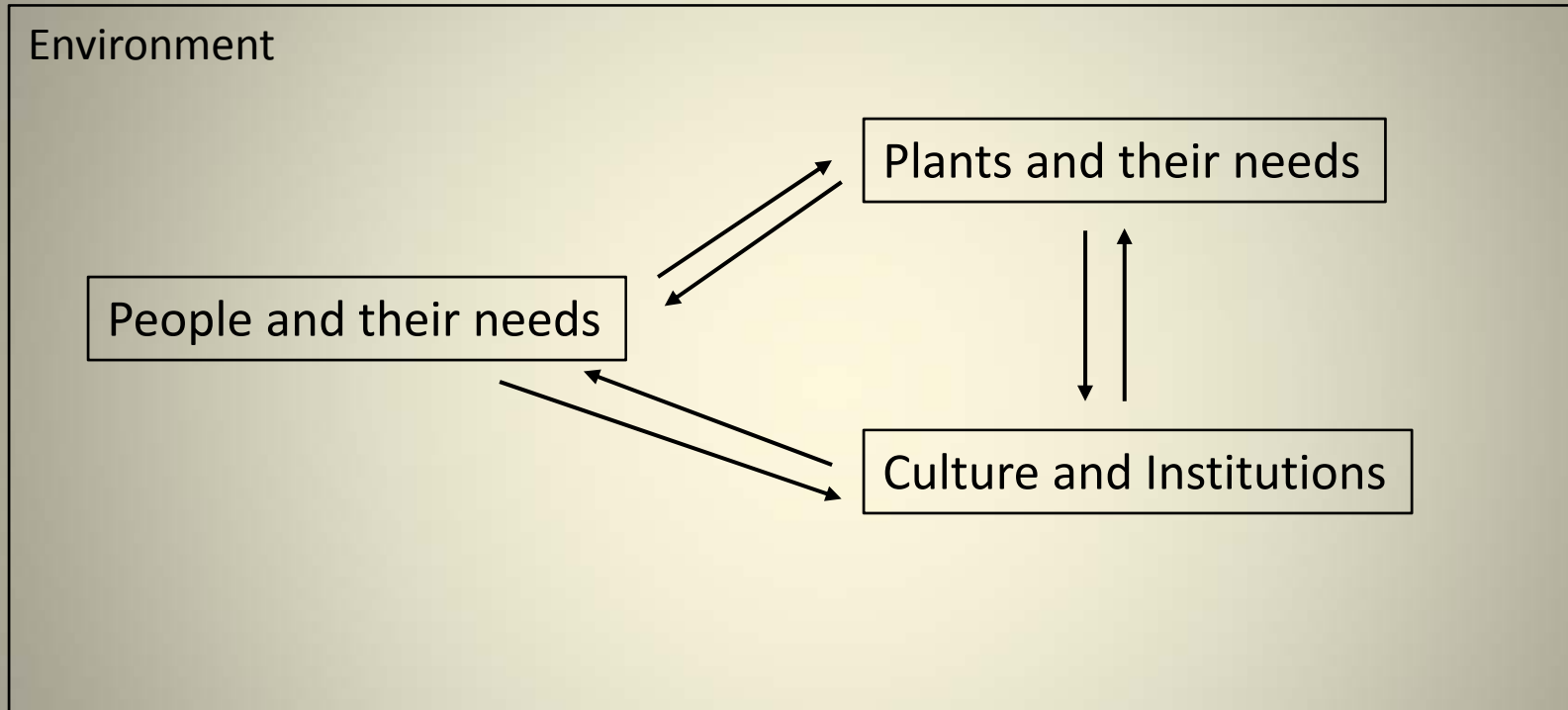
What we need to think about next.



How did the groups we looked at previously fit this picture?



How do the swidden fallow groups fit the picture?



This is a stop and think point.

Global Literacy	What is being assessed
3.1 Global Awareness	Awareness of the scales of human impact on the natural/human world
3.2 Perspective Taking	Awareness of diverse perspectives and open-mindedness
3.3 Cultural Diversity	Knowledge of cultural diversity across a spectrum of difference.
3.4 Understanding Global Systems	Ability to examine global systems
3.5 Applying Knowledge to Contemporary Global Contexts	Ability to apply knowledge to address global challenges from diverse perspectives



A globally literate student will demonstrate the ability to understand and analyze issues on multiple scales and from diverse perspectives, acknowledging interconnectivity and complexity. As globally literate, students should 1) become informed and open-minded people who are attentive to diversity across the spectrum of differences, 2) seek to understand how human actions impact the human and natural world on multiple scales, and 3) address the most pressing and enduring global challenges while considering context, complexity, and interconnectivity.

Global Literacy	What is being assessed	Beginning 1	Developing 2 - CORE 2000	Proficient 3	Exemplary 4
3.1 Global Awareness	Awareness of the scales of human impact on the natural/human world	Recognizes that human action impacts the natural and human world on a single scale	Recognizes that human action impacts the natural and human world on multiple scales	Analyzes some relationships between multiple scales to understand how human actions impact the natural and human world	Analyzes the complexity of relationships between multiple scales to understand how human actions influence the natural and human world
3.2 Perspective Taking	Awareness of diverse perspectives and open-mindedness	Little/no recognition of multiple perspectives	Recognizes the existence of multiple perspectives while maintaining a value preference for one perspective	Analyzes topics from multiple perspectives while valuing contributions from these perspectives	Synthesizes multiple perspectives to analyze complex topics
3.3 Cultural Diversity	Knowledge of cultural diversity across a spectrum of difference.	Little/no knowledge of cultural diversity	Demonstrates some knowledge of different cultures while maintaining a value preference for one culture	Recognizes commonalities between cultures while respecting cultural differences	Analyzes in depth patterns of commonalities and differences in cultures using a culturally relativistic lens
3.4 Understanding Global Systems	Ability to examine global systems	Little/no knowledge of global institutions, processes, or trends	Demonstrates some knowledge of global institutions, processes, or trends	Recognizes interactions between multiple global institutions, processes, or trends	Analyzes the complexity of interactions between multiple global institutions, processes, or trends
3.5 Applying Knowledge to Contemporary Global Contexts	Ability to apply knowledge to address global challenges from diverse perspectives	Little/no knowledge of global challenges	Demonstrates basic knowledge of global challenges and/or awareness of simplistic solutions	Analyzes global challenges while demonstrating awareness of more complex solutions	Develops or evaluates more complex solutions to global challenges that are appropriate to the context



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