Innovation as Adaptation:

Institutional and technological approach to alleviate climatic constraints in Nepal's agriculture

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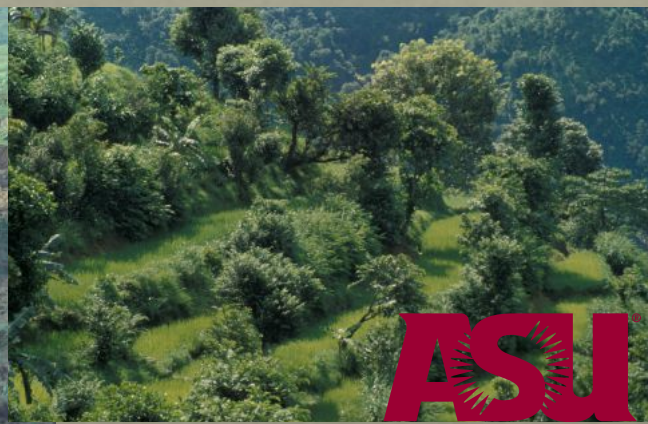


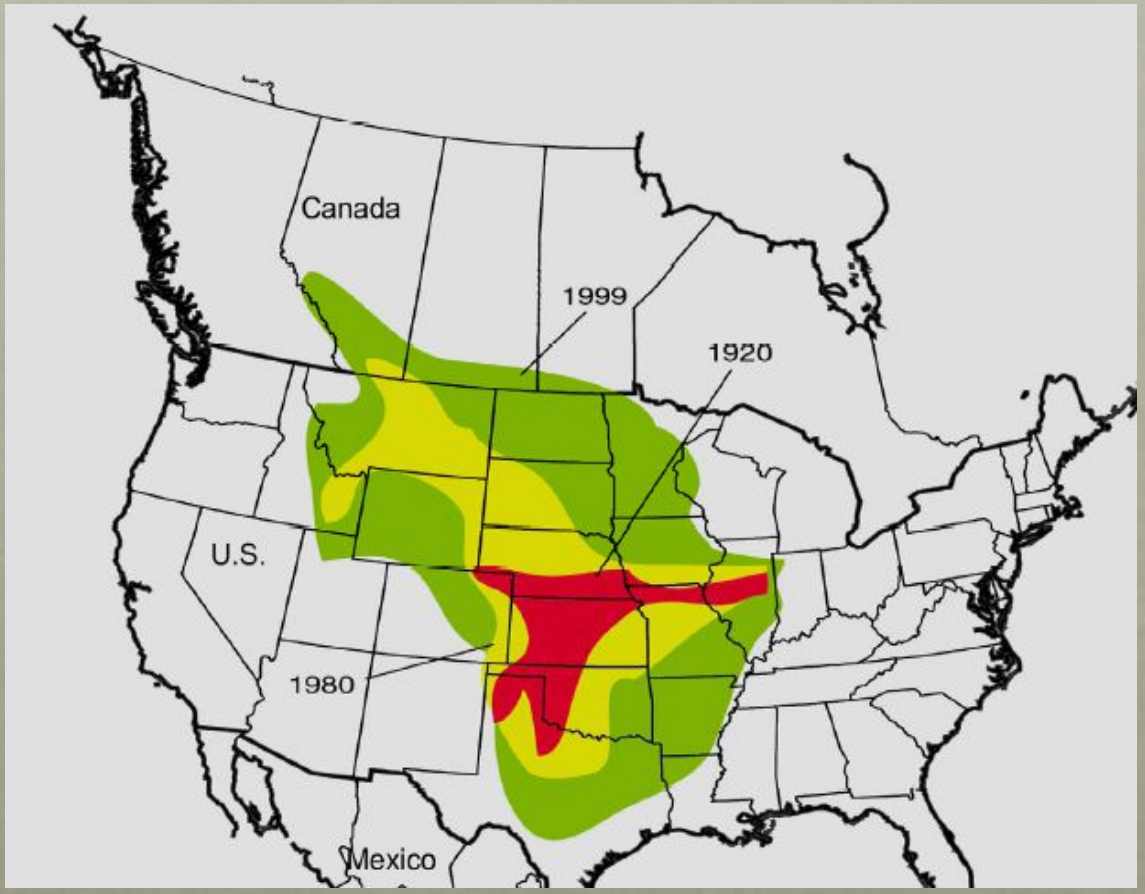
Innovations are human adaptations

…wheat and maize moved from their agricultural homeland to diverse physiographic region

Source: Manningm 2005

Photo credit: Google image

….in essence, crop migrations were the earliest documented example of agricultural adaptation



Extent of the hard red winter wheat in North America: 1920, 1980 and 1999 (Source: Rosenberg (1982), Economic Research Service,USDA, 1999

.....single gene separates the morphology & reproduction traits of Teosinte & Maize

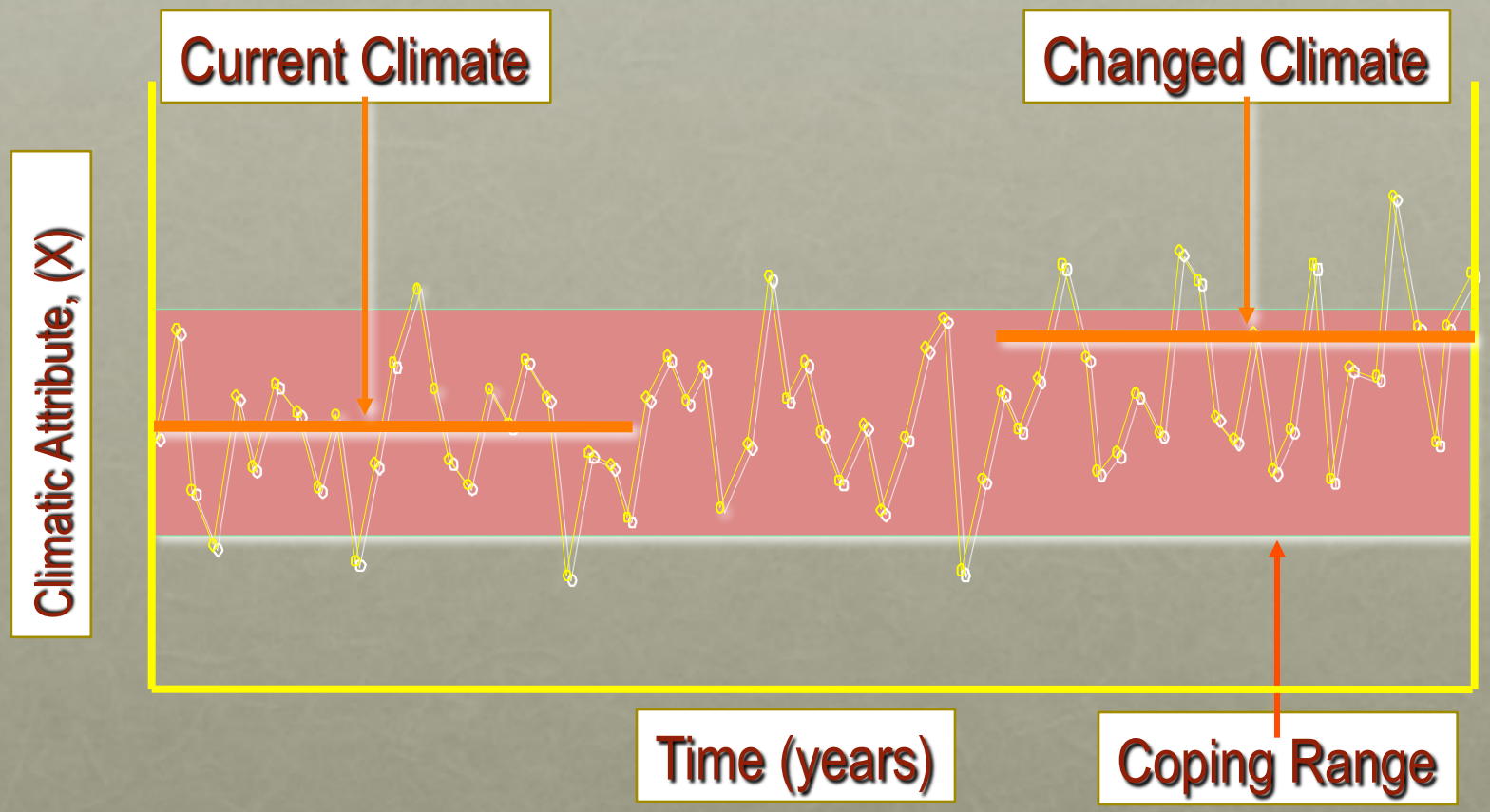
Source: Fedoroff, 2003

Photo credit: John Doebley

insecurity and shortages can become a powerful driver of technological and institutional innov


Photo curtsey: Mahesh Shrestha, LI-BIRD

… today, the world farmers face a different kind of challenge - climate



Source: Smith et al., 2001

…adaptation as innovation

If climatic constraints are confronted with innovations on demand it will alleviate the inadequacies of climatic resources

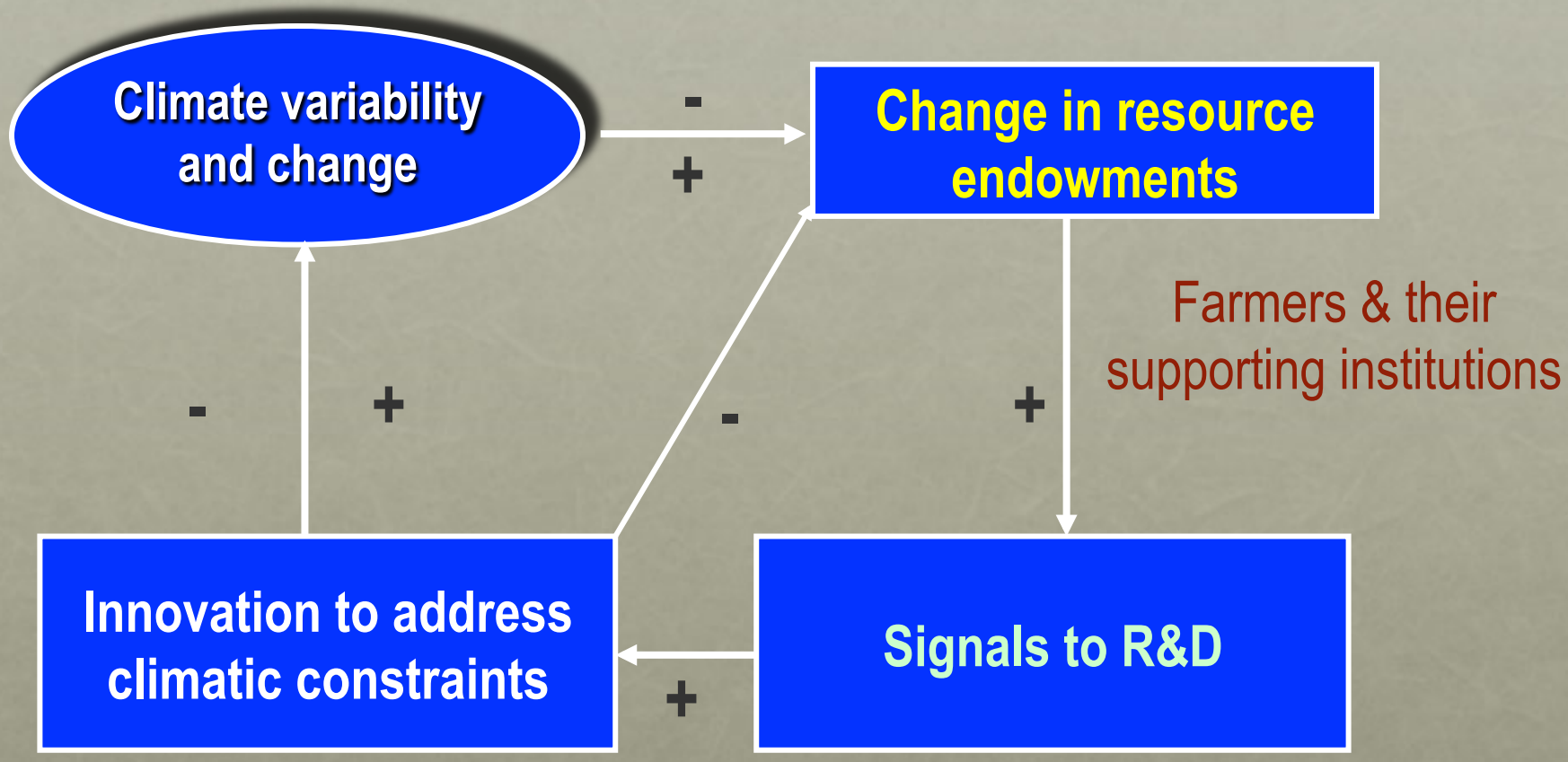
…assessing their *raison d'être* as new knowledge about climate change emerges


Photo curtsey: Mahesh Shrestha, LI-BIRD

..institutions mediate response to new demands

Photo curtsey: Mahesh Shrestha, LI-BIRD

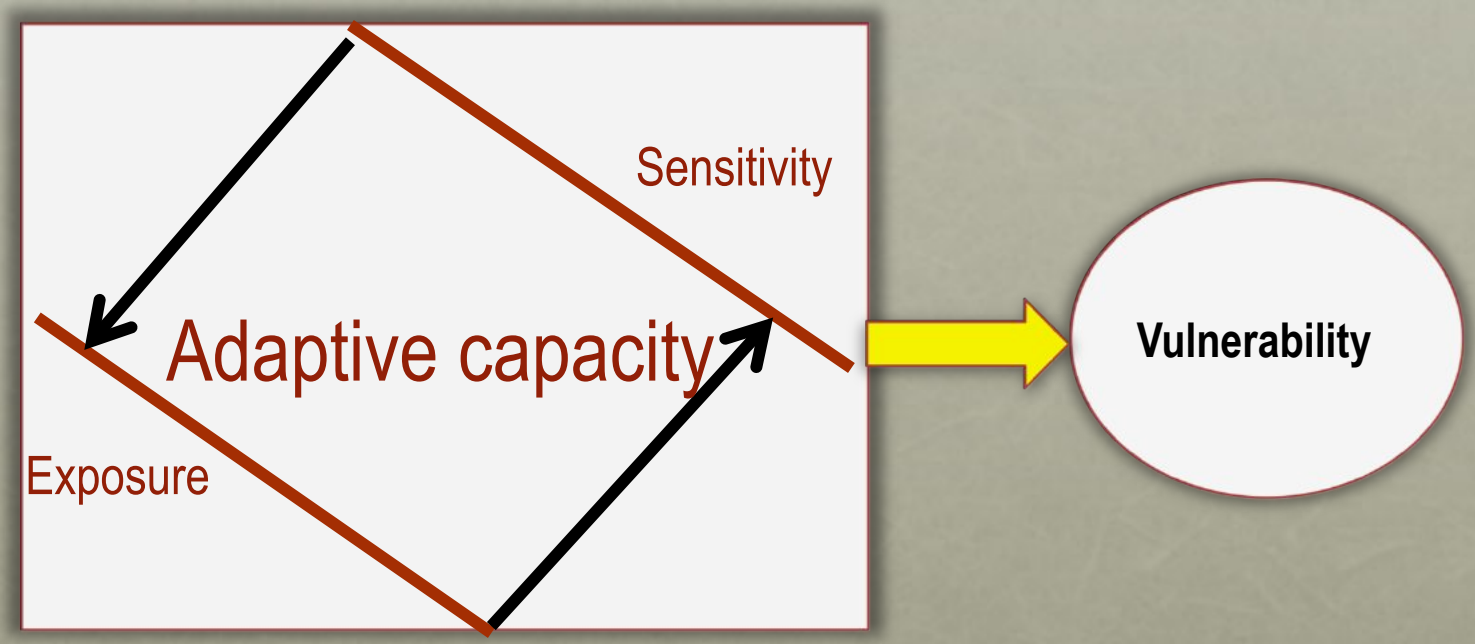
..innovations to eliminate the effects of climate on agriculture



+ = positive change, - = negative change

Chhetri and Easterling, *Annals* 2010

..innovation through collaboration and networking increases adaptation toolkit ….



After - Engle, *GEC* 2011

Adaptation toolkit: Socio-agroecological systems

Inputs	• Water, energy, labor, land, fertilizers and pesticides
Technological Innovation	• Breeding and specialized equipment • Energy, water and soil conservation • Pest and disease management • Information and technology
Human ingenuity in SAS	• Crop and animal translocation • Improved agronomic practices (including post H) • Market development • Institutional arrangement
Knowledge creation and management	• Monitoring environmental systems • Outreach and information dissemination • Research and Development

Source: Easterling, 2011

Insights about the role of climate as a stimulus to innovation are crucial to improve adaptation toolkit

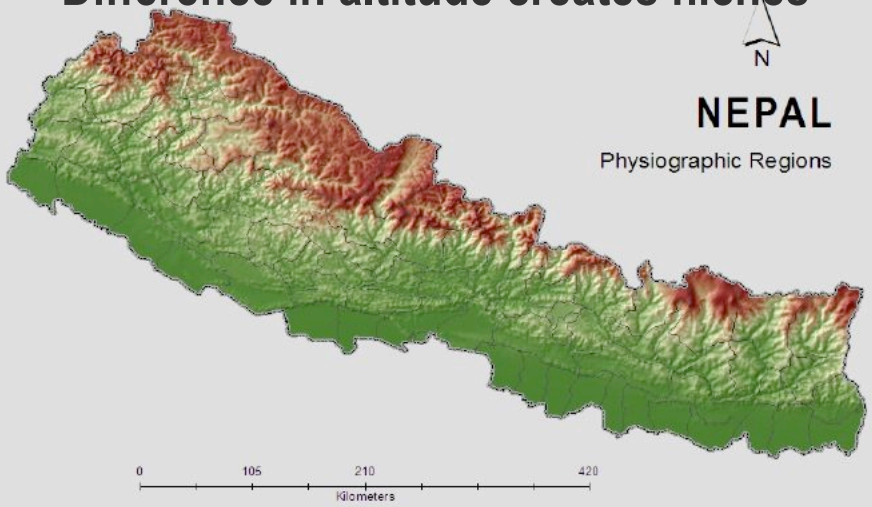

Mountain


Hills

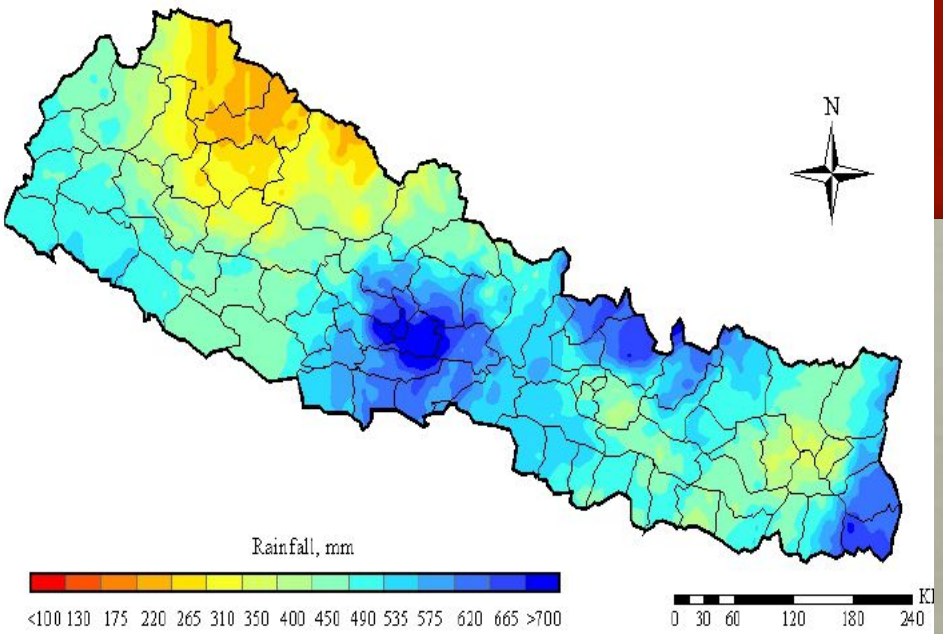

Flat Terai


Valleys

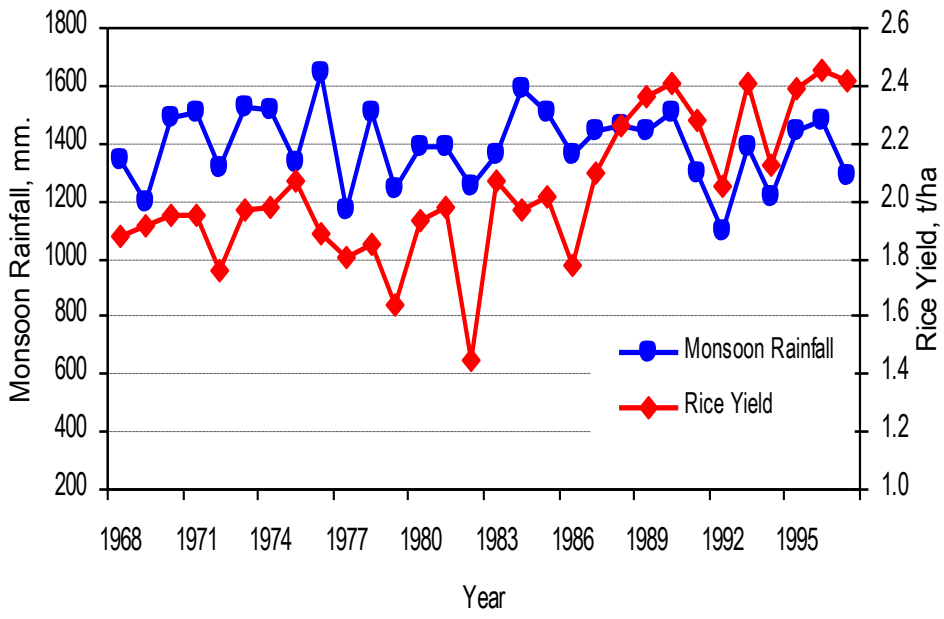
Difference in altitude creates niches



Courtesy: M. Shrestha



Does variation in climatic resources prompt the innovation of location-specific technologies?



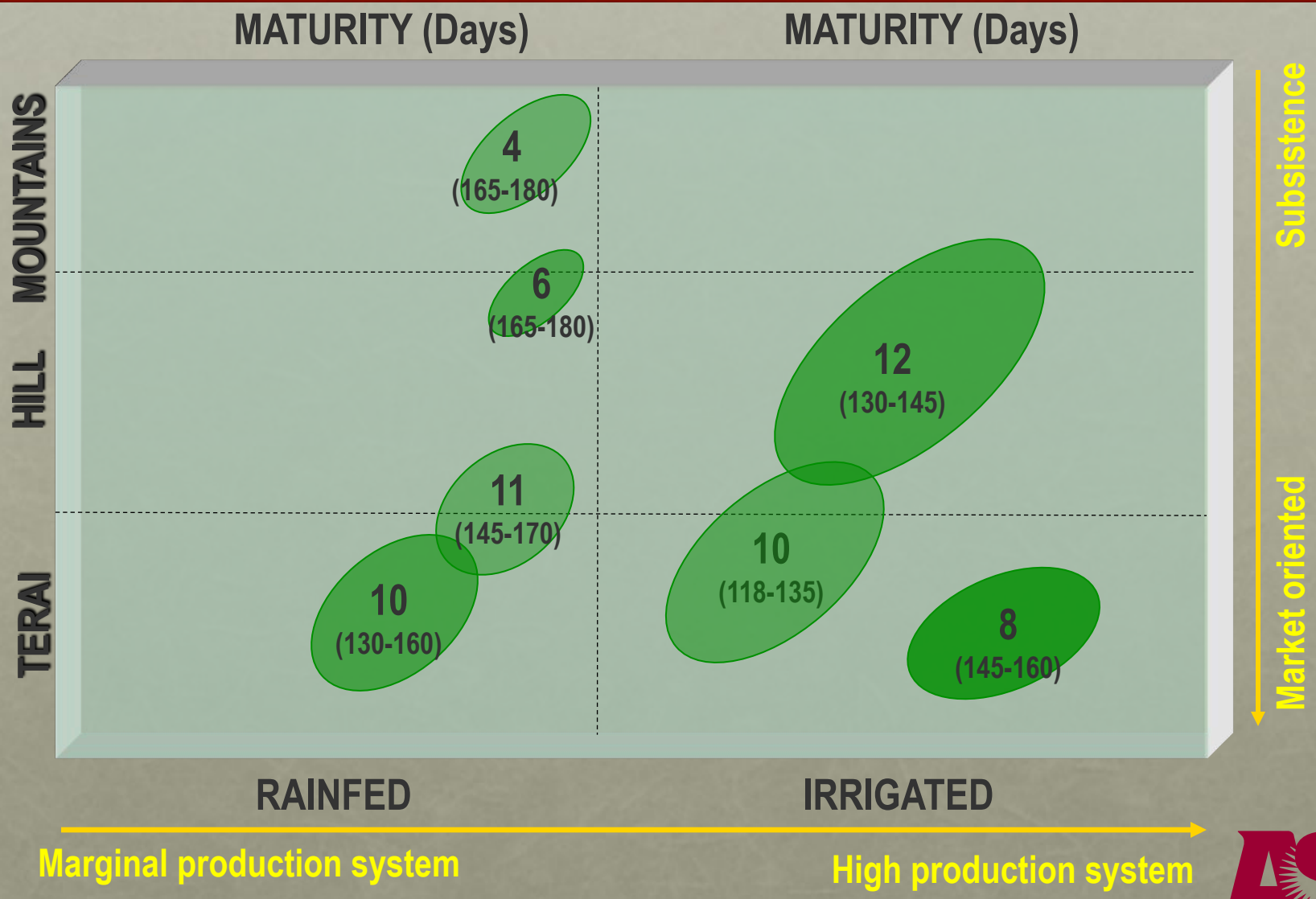
Why monsoon is so important?

Source: myrepublica.com

Source: myrepublica.com

July rainfall is critical for the establishment of rice in the field

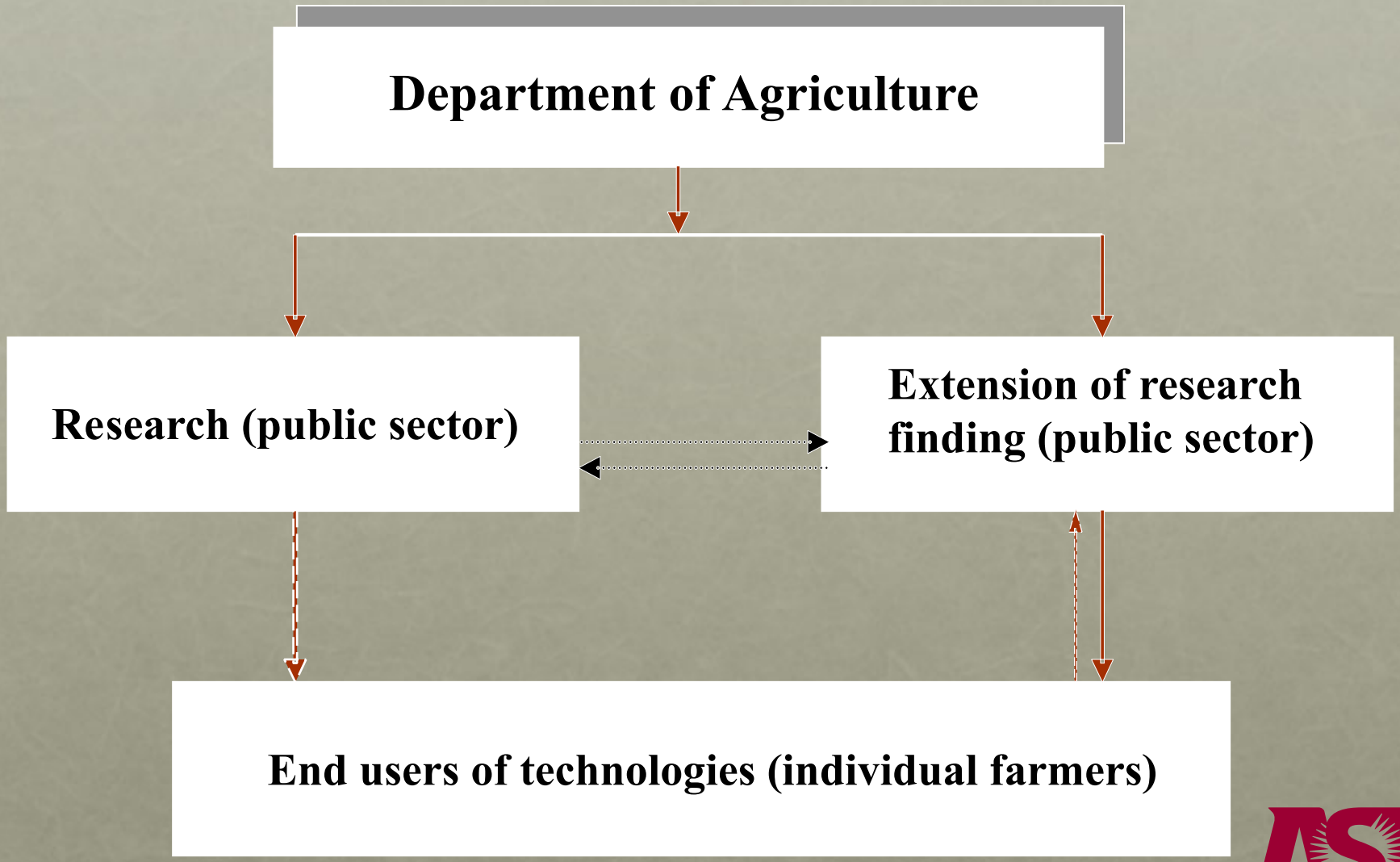
Improved rice varieties released



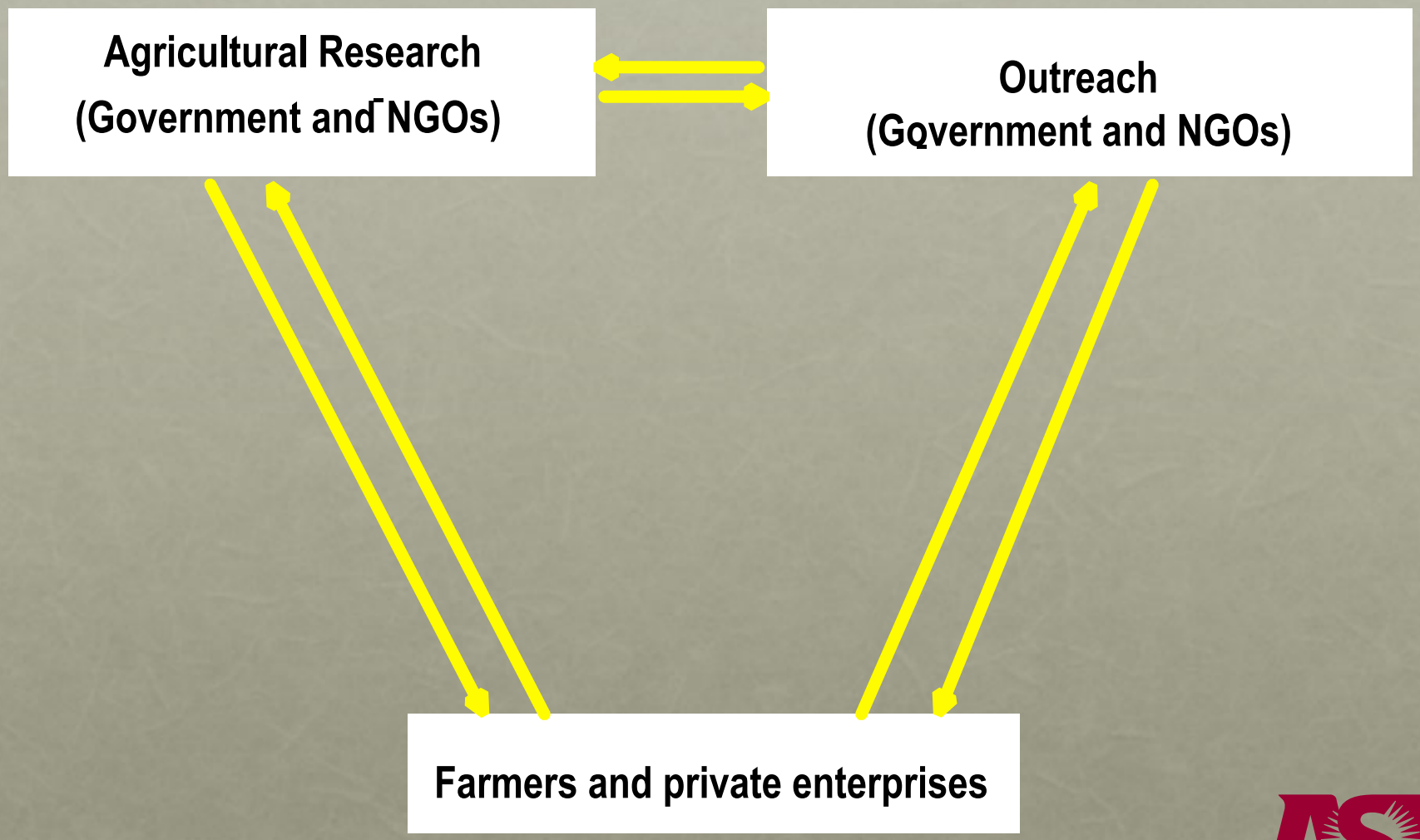
	Targeted traits	R&D Approach
1966-80	HYVs, Insect & disease resistant, fertilizer responsive	Top-down; govt. led; minimal collaboration; commodity-specific; limited focus
1980-95	+ Short duration Drought resistant Biomass yield (straw)	Top-down, FSR approach; govt. led; farmers as passive partners; minimal collaboration
1995-to date	+ + Rainfed & Marginal areas Mountain & Hill regions	New institutional space; coproduction of knowledge; focus on PTD, GRB, & PPB; engagement with farmers; coalition (multi-institutional) including universities

Chhetri et al., JAPG *2012*

Top down model: Agricultural R&D
Before mid 1990s



Shifting landscape of agricultural R&D
After mid 1990s



… features of PCI approaches

PCI methods	Features
Grassroots Breeding	Selection from the diversity of population of local landraces against farmer-preferred traits
Participatory Variety Selection	Selection among the fixed lines
Participatory Plant Breeding	New variety developed by combining preferred and useful traits of modern and local cultivars
Client-oriented Breeding	Clients demand addressed

Comparison: conventional and participatory breeding

Criteria	Conventional	Participatory
Approach	Researchers centered	Farmers centered
Farmers participation	Low	High
Time when farmers involved	After 8th generation	Selection of parents, desirable trails, crossing, testing, adoption
Duration (new variety)	14-16 years	8-10 years
Meeting farmers' expectation	Low	High
Driving force	Supply driven	Demand driven
Conservation goal	Not considered	Prime

If farmers & their supporting institutions have appropriately responded to present climatic constraints then they are generally better prepared to adapt to changing climate

Adaptive capacity is clearly related to the ability of institutions to mobilize resources in areas that are relevant to climate adaptation