Why Does Crop Diversity Matter?

'Crop diversity is a life insurance for crops (and the people who eat them)'

'The susceptibility of monocultures is the Achilles tendon of global food production'

'We need to keep redundancy in our crops'

'Crop diversity replaces boredom with delight'

'Our world would taste very different without diversity'

'Sameness leads to monotony and limits (culinary) creativity'

'Nature can be understood as an immense pool of information with unprecedented benefits for our economy'

'Genetic material is a treasure which we should use in a clever way'

Why Does Crop Diversity Matter?

'These plants will be so pushed to perfectly meet our needs that they can no longer meet their own. Their genepool will be so small, that they can't propagate alone, can't adapt to the environment, they grow when we want them and they are alone, with no more wild relatives – the genetic dead end. Evolution has become a spectator'

'Why fight a war for the crop when it is best fought for itself'

'This [genetic engineering] will lead inescapably to problems with monopoly of seed production and big companies making a lot of money from poor farmers'

'To monopolize diversity is hard, if not impossible'

'The focus on diversity is a luxury'

Why Does Crop Diversity Matter?

Diversity as a luxury or a necessity? Different strategies for subsistence smallholder farmers vs intensive large scale industrial agriculture? – uniformity achieved via high inputs of fertilizer / pesticide / breeding / energy

- Insurance against pests and diseases & climate change – bananas, potatoes, either directly or for future crop breeding – economic value for crop breeding
- Local adaptation, site matching, crop rotation, soil maintenance, sustainability, risk reduction
- Extend season of production (early / late ripening) in relation to markets, processing, storage
- Associated biodiversity, > diverse ecosystems = > sustainable?, wider environmental benefits
- Health & nutrition
- Aesthetics – taste, shape, colour, texture, culinary richness of human experience
- Cultural as well as biological heritage of our ancestors – knowledge, history, cultural diversity, sense of place, sense of community, common ground
- Ethical responsibility, ownership issues, monopolies and control




BIO 235
Plants & People
Evolution &
Domestication
of Crops







Lecture 10 - Genes in the Field - Crop Genetic Diversity and Conservation

- domestication as a genetic bottleneck
- selection after domestication, crop genetic diversity, traditional and modern varieties, crop wild relatives;
- diversity and risk
- erosion of crop genetic diversity
- *ex situ*, *in situ* and *circa situm* conservation
- germplasm banks, the Vavilov Institute
- Convention on Biological Diversity, CBD
- Consultative Group on International Agricultural Research, CGIAR
- genes in the field, growing diversity and on-farm conservation of crop diversity
- *Fructus* , *ProSpecieRara*, *Retropomme*

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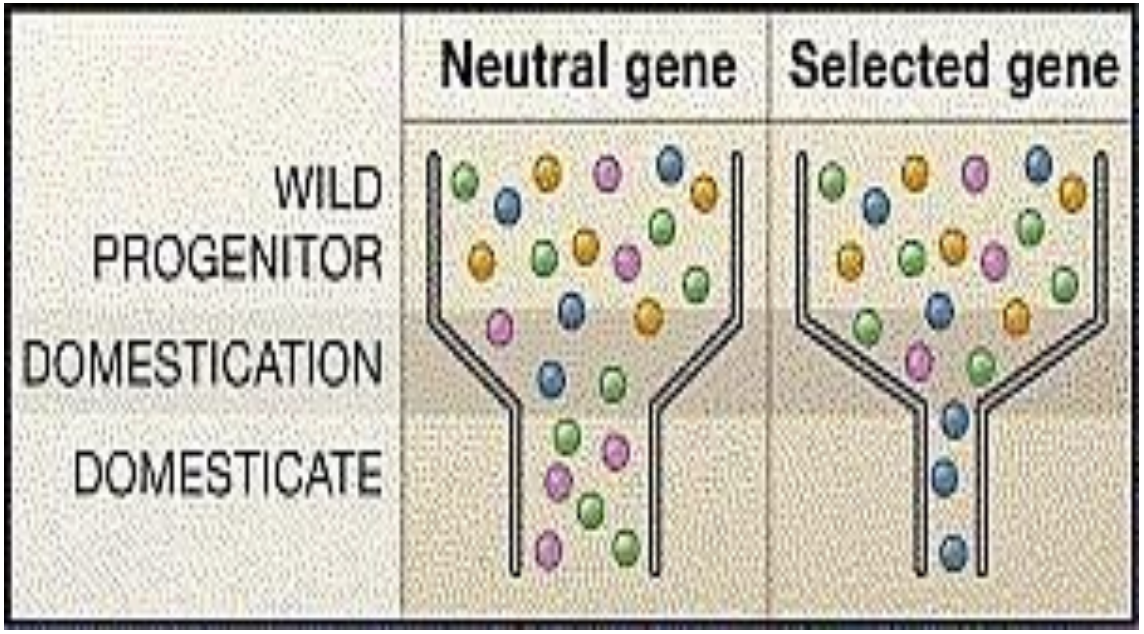
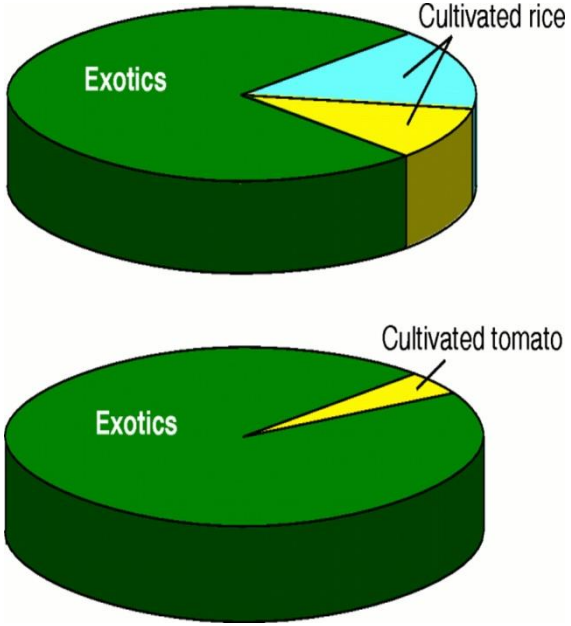
The Effects of the Domestication Bottleneck on Genetic Diversity



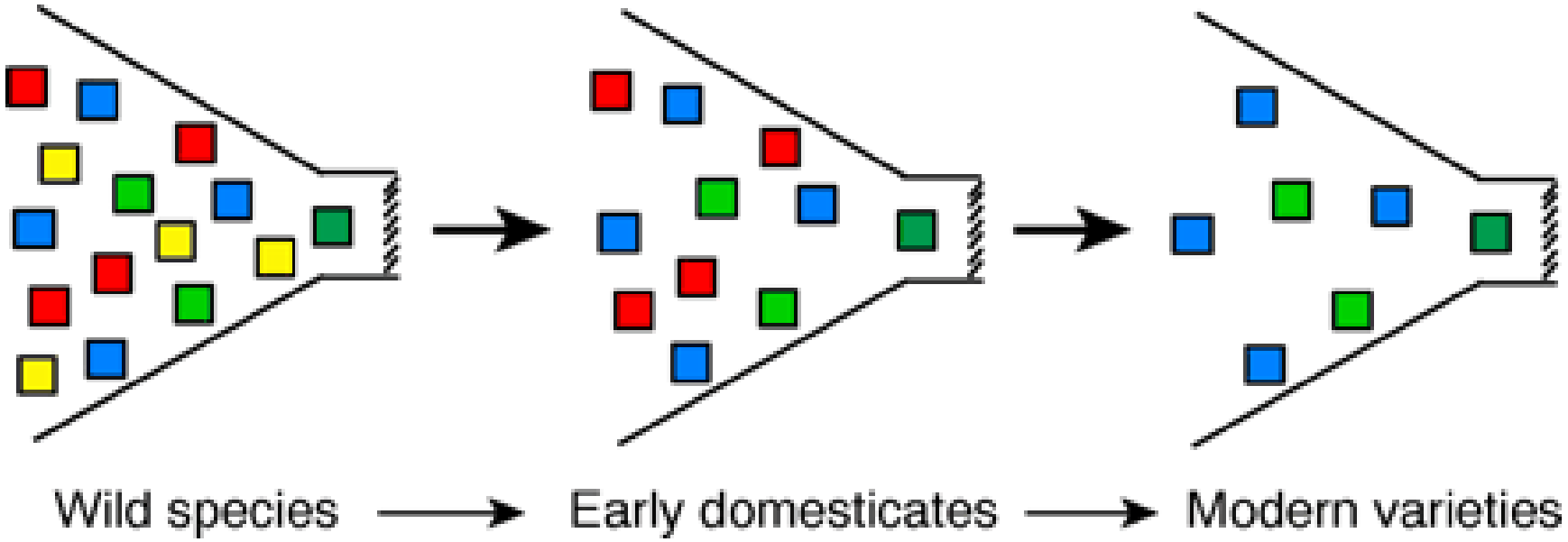
Doebley et al 2006 Cell



Tanksley & McCouch 1997

- Rice: cultivated rice contains 22-28% of the total haplotype diversity found in wild rice (Londo et al., 2006)
- Maize & wheat: cultivated maize and wheat contain c. 65% of the genetic diversity found in wild maize and wheat (Buckler et al., 2001)
- For most crops, domestication appears to have involved an intense genetic bottleneck

The Effects of the Domestication Bottleneck on Genetic Diversity



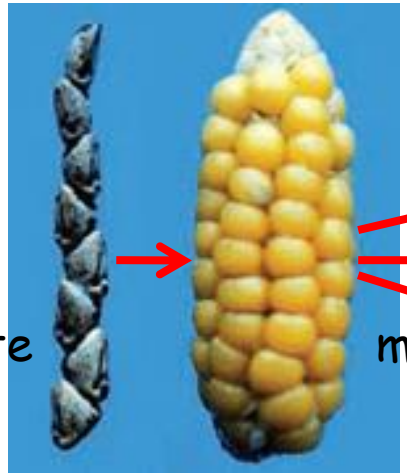
Soya bean: *Glycine max*

220 million metric tonnes on 92 million hectares

>86% of genes present in modern-day N. American cultivars traced to just 17 lines used in initial breeding programme; 19,000 accessions in USDA germplasm collections

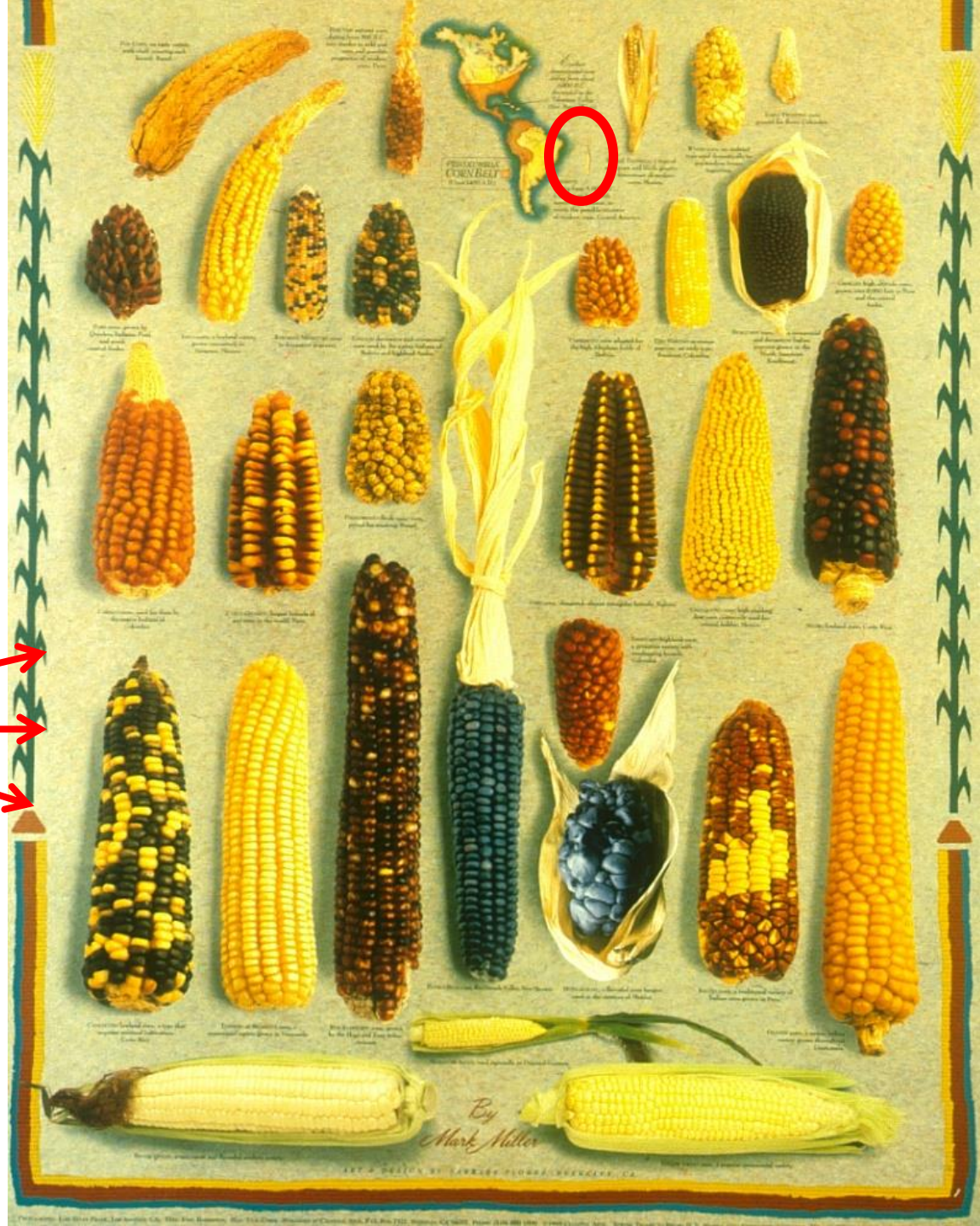
Roundup Ready Genetically-Modified soybean accounts for 91% USA, 98% Argentina, 53% Brazilian production

Selection after domestication / crop diversification



teosinte

maize



Selection after domestication & crop diversification

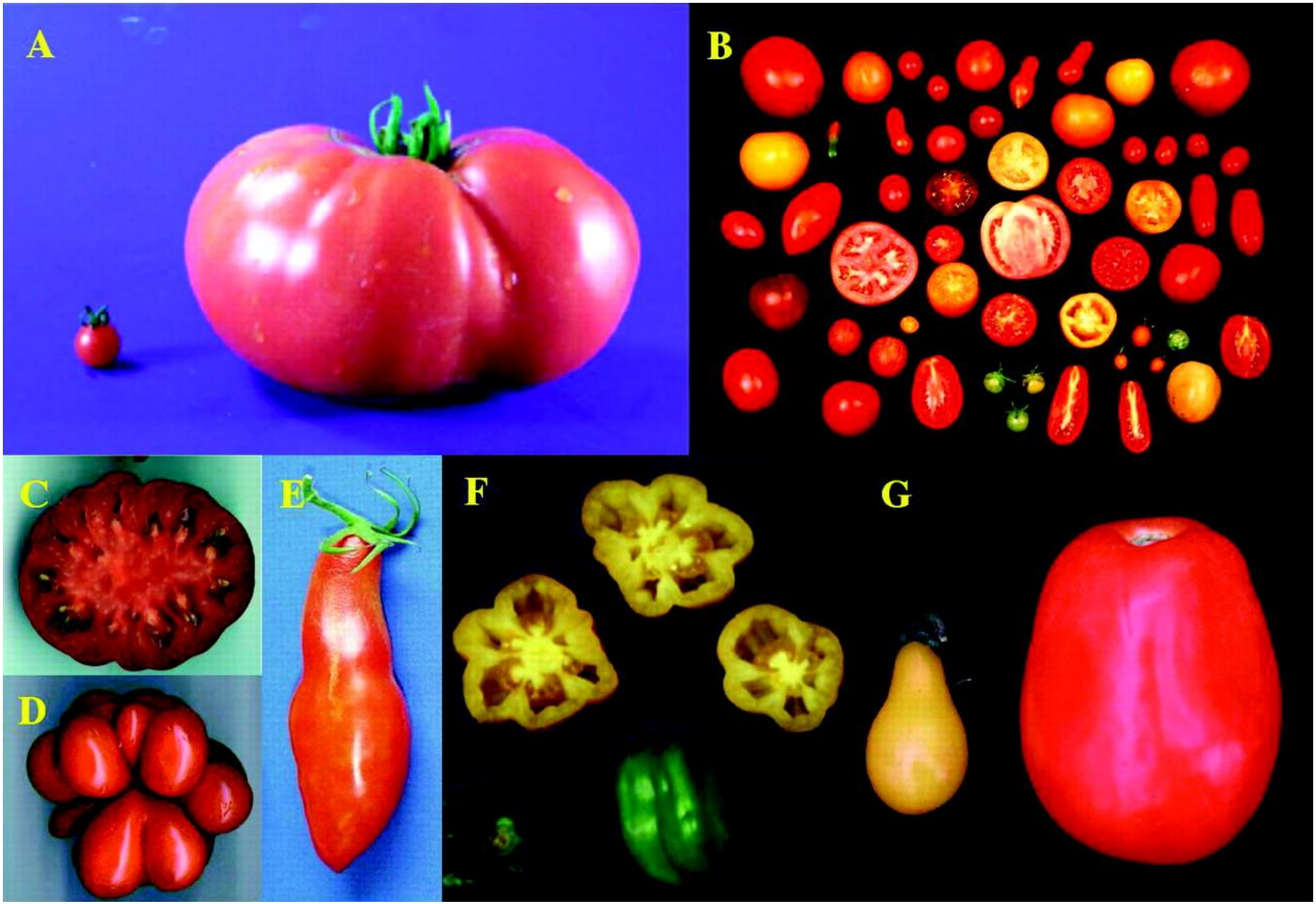
Selection after domestication has led to the immense diversity in varieties and phenotypes that characterizes many domesticated plant species, which, as Darwin pointed out, can exceed the range of phenotypic variation in their wild ancestors. Selection for crop diversification leads to local adaptation, driven by human groups developing varieties with:

- preferred cooking, processing and storage qualities
- the ability to grow in new environments and adapt to variable environments
- different growing periods and seasons of production – early & late varieties
- desirable visual or gustatory features

Examples: Darwin's pigeons, dogs & chickens; bananas, maize, chiles, potatoes, tomatoes

Unlike domestication traits, however, selection for crop diversification may involve a greater level of conscious selection, as human cultures deliberately chose varieties with the desired characteristics.

Selection after domestication / crop diversification


A
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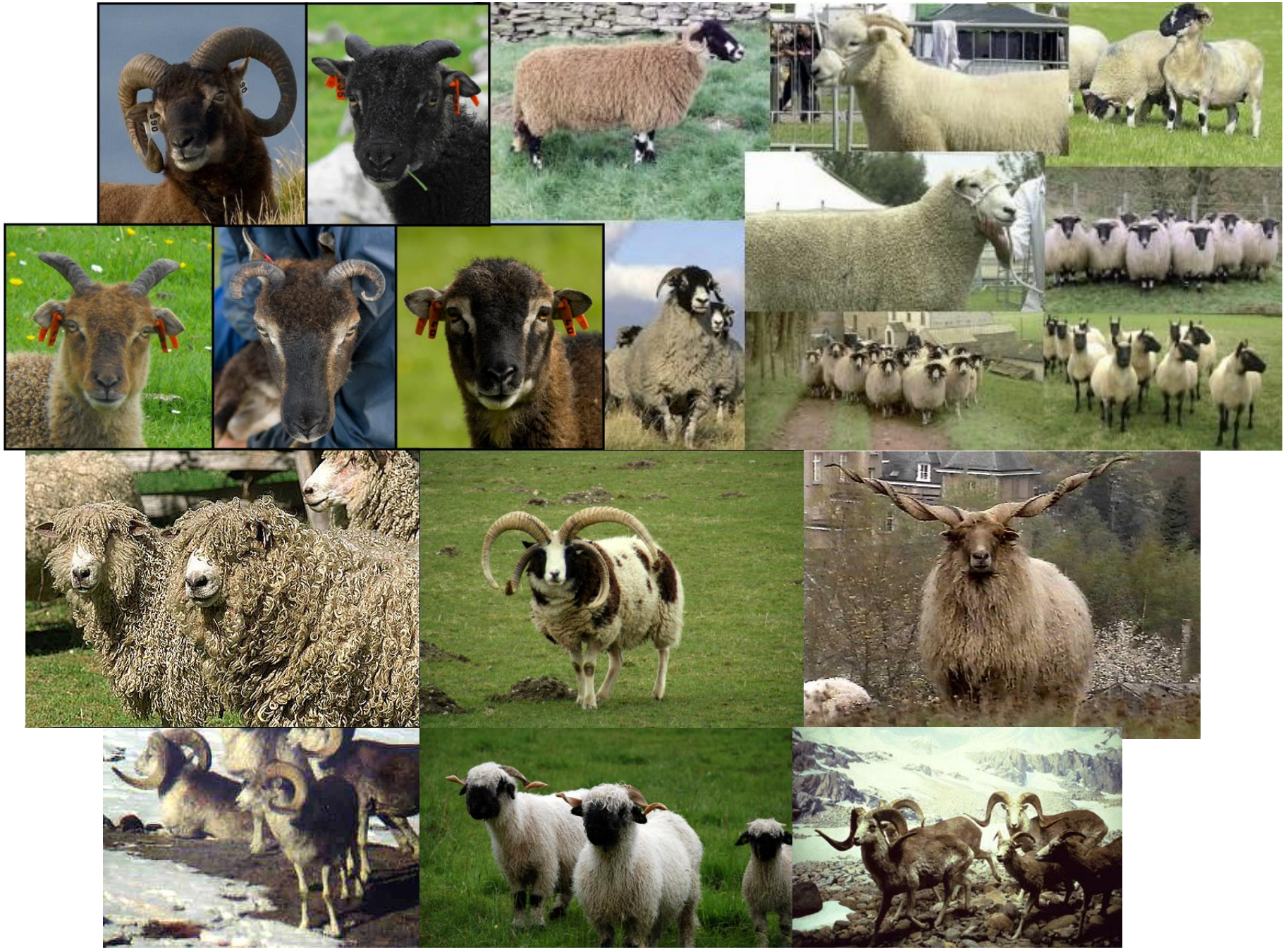
Directed selection after Domestication

Directed selection after Domestication



Landrace potato cultivars are highly diverse. In the Andes, this complexity translates into a cornucopia of potato races developed by pre-Inca farmers – the Peruvian blue potato, reds, pinks, yellows and oranges, all manner of thin and fat ones, smooth-skinneds and rough, short-season and long, drought-tolerant and water-loving, sweet tubers and bitter ones, starchy potatoes and others almost buttery in texture – some 3,000 different land races in all. This extravagant harnessing of wild diversity in the Andes, owes partly to the early Andean farmer's desire for variety, partly due to their flair for experimentation, and partly the complexity of their agriculture, the most sophisticated in the world at the time of the Spanish conquest. The Incas had figured out how to grow impressive yields of potatoes under often harsh, extremely variable, and uncertain conditions encompassing different altitudes and orientations that demand diversity – a different tuber for every environment. A polyculture. From Michael Pollan '*The Botany of Desire*'

Potatoes in Modern Agriculture – Idaho, USA
An industrial monoculture feeding global fast food

Local adaptation and productivity

Seed saving → local adaptation

Experimental verification using a synthetic population of 28 barley varieties sown in a large plot in 1929. Subsequently allowed to reproduce by natural crossing without artificial selection, with a random sample of seeds collected and sown annually.

Over the ensuing decades, they documented dramatic changes in gene frequencies, resulting in higher and more stable grain yields, with more compact and heavier spikes, with larger numbers of seeds.

Suggests adaptation via incorporation of increasing numbers of favourably interacting alleles into large synergistic complexes. This also accompanied by striking ecogenetic differentiation among local populations that occupy unlike habitats.

Local adaptation & traditional maize seed systems

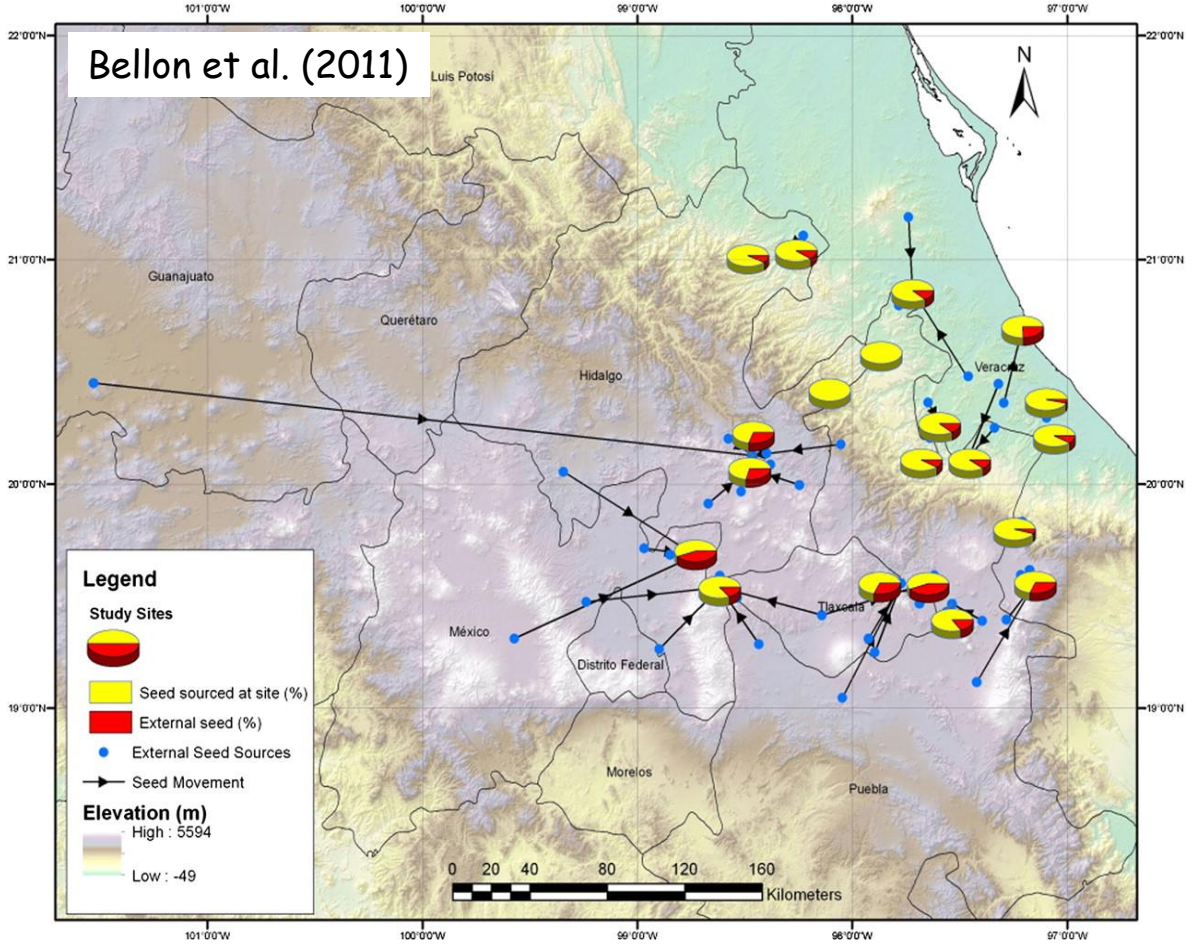
- 80% of maize in Mexico is planted with recycled seed, i.e. seed selected from the previous harvest by farmers

- > 90% of seed obtained within <10km and < 50m elevation

- >1 seedlot per farmer; communities maintain 5x diversity of individuals

- role of improved varieties and formal seed system is minimal

- stable and consistent selection pressures on maize populations both from farmers and environment and hence strong selection for local adaptation



Traditional maize seed systems

- Seed saving is motivated by trust of one's own seed, close matching to sites and markets generating a demand for diversity as one part of managing risk; security; saving money; social norm of a good farmer with losing seed = humiliation; elements of inheritance and seed held in trust and a link to ancestors with seed saving as a way of conserving and honouring important ties.

- Seed system is fundamentally a moral system based on trust and community and social responsibility for mutual assistance, rather than ownership, commerce and maximising profits

- Not closed / static - >25% of farmers experiment, but retention is low. Motivations for obtaining seed from outside: lack of sufficient saved seed; experimentation – curiosity, but small scale and on the periphery of the seed system.

- Fundamentally conservative but with elements of innovation, generating overall resilience.

Rice in the Cordillera region of the Philippines

400-2,000 year-old terrace system

Cultivated by smallholder farmers who use at least 40 different varieties of rice

Stable systems spanning generations of farmers

Gruber (2016)

>4,000 cultivated varieties of potatoes in the Peruvian Andes

Nutritional value of crops & micronutrient malnutrition

Green Revolution – strong emphasis on yield and taste at the expense of nutritional value such that major crops such as the most widely cultivated and highly bred varieties of rice, wheat and maize have significant nutritional deficiencies

The importance of traditional / heirloom varieties and crop wild relatives for making crops more nutritious

Rice – huge reliance on rice for calory intake while heralded as one of the major success of the Green Revolution, masks a hidden hunger of micronutrient malnutrition – iron, zinc, vitamin A, vitamin B.

Use of Wild Relatives in Crop Improvement

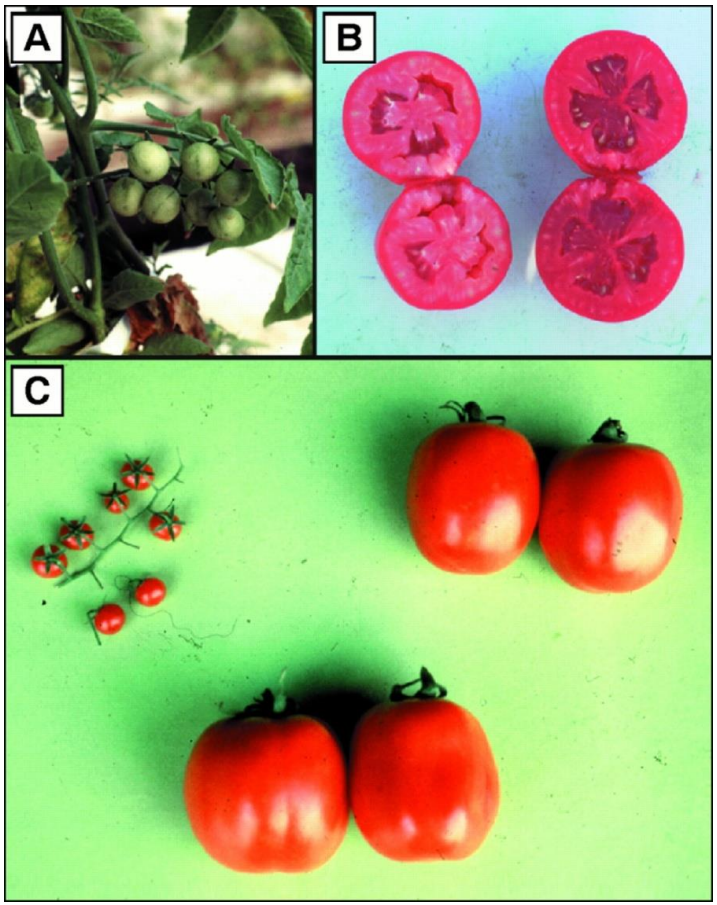
	Pest & disease	Abiotic stress	Yield	Quality	Male sterility	Total
Cassava	+	-	-	+	-	3
Wheat	++++++++++	-	+	+	-	9
Millet	+	-	-	-	+	3
Rice	+++++++	+++	+	-	+	12
Maize	+	-	-	-	-	2
Sunfl	+++	+	-	-	+	7
Lettuce	+++	-	-	-	-	2
Banana	++	-	-	-	-	2
Potato	++++++	-	-	-	-	12
Peanut	+	-	-	-	-	1
Tomato	++++++++++	++	-	++	-	55
Barley	-	+	-	-	-	1
Chickpea	-	+	-	-	-	2

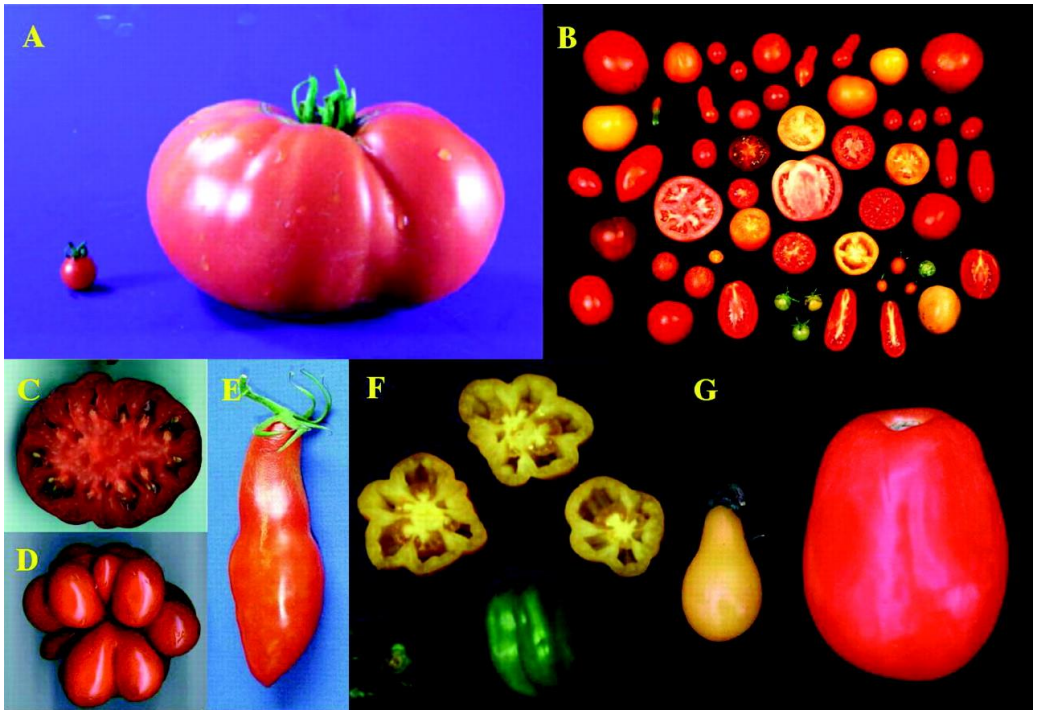
- Releases of cultivars containing genes from crop wild relatives
- Dominated by genes conferring pest and disease resistance introgressed into crops such as tomato, potato, rice and wheat.
- Looking for phenotype vs looking for the gene
- Overall contribution of crop wild relatives remains limited, esp for complex yield traits
- Crop breeding and modern agriculture still reliant on a very narrrow genetic base

Hajjar & Hodgkin (2007)

Hugh Iltis (1988) – Serendipity in the exploration of biodiversity – what good are weedy tomatoes?

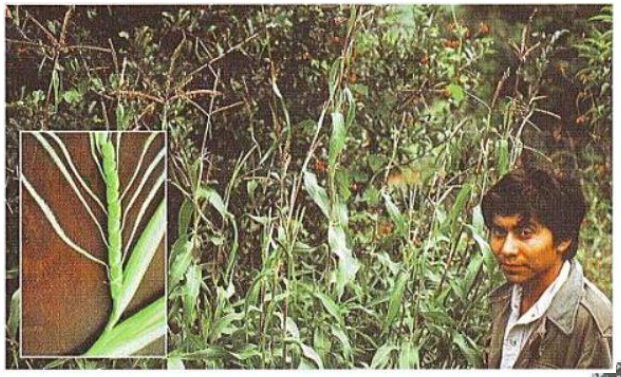
Lycopersicon chmielewskii genes worth $8 million per year to the tomato industry





Recent botanical exploration and discovery of maize relatives

1979 – Rafael Guzman and the discovery of *Zea diploperennis*, 2200-2400m, Sierra de Manantlan, western Mexico
Iltis et al (1979) *Science*



Zea diploperennis (Gramineae): A New Teosinte from Mexico

Abstract. *A perennial teosinte or "wild maize" endemic to the Cerro de San Miguel, Sierra de Manantlan, Jalisco, Mexico differs from* Zea perennis *by dimorphic rhizomes, robust habit, and a larger number of longer, laxer tassel branches. The fact that it is a diploid (2n = 20) has taxonomic and agronomic significance. The seeds are used locally for food.*

Earlier this year, Guzmán (*1*, *2*) reported his remarkable rediscovery of perennial teosinte, thought extinct in the wild since 1921 (*3*), at two sites in southern Jalisco, Mexico. Subsequently, both sites were visited by three of us (H.H.I., J.F.D., and R.G.M.), and specimens, seeds, and rhizomes were collected and initial analyses were made. This report confirms Guzmán's conclusion regarding the Ciudad Guzmán population—that it is, indeed, conspecific with the tetraploid (2*n* = 40) *Zea perennis* (Hitchcock) Reeves and Mangelsdorf, originally discovered in this area by Hitchcock in 1910. However, the plants from the second location, Cerro de San Miguel, though similar in many ways, are a clearly distinct diploid taxon, here described for the first time:

Zea **diploperennis** Iltis, Doebley & Guzmán. **sp. nov.**

Similis a *Zea perennis* sed robustior, culmis 1–2 cm diam., rhizomatibus perennibus dimorphis (gracilioris non nisi 5–15 cm × 5–10 mm, brevioris crassis, tuberosis 1–4 cm × 9–15 mm), uterque cum internodiis brevibus 2–6 mm longis, foliis multo majoribus (40–80 × 4–5 cm), inflorescentiis ♂ cum 3–13 ramis, robustioribus et 6–15 cm longis. Typus: Iltis, Doebley & Guzmán 450.

Robust, erect, maizelike, loosely clump-forming perennial, with five to ten, or more, primary culms from one rhizome system; rhizomes of two intergrading sorts, (i) *cordlike long shoots*, 5 to 15 cm long, 5 to 10 mm in diameter, these with many dense short (2 to 6 mm) internodes, scaleless when mature, usually vertical or strongly ascending and changing abruptly into the much thicker culms, or less often horizontal and producing one to several culms from short lateral shoots, or (ii) *thick and tuberous, ovoid to obovoid short shoots* 1 to 4 cm long, 9 to 15 mm in diameter, each of these produced horizontally from the lowest two or three nodes of the primary culms, clothed when young with triangular, strongly convergent-veined, overlapping, connivent scales, at times growing upward (into a long shoot?) and producing a culm, or sometimes remaining dormant to eventually produce one to four lateral short or long shoots (or both).

Primary culms 10 to 25 dm tall, 1 to 2 cm in diameter, unbranched (or with one to three inconspicuous lateral branches), the nodes, internodes, and leaf sheaths glabrous throughout except for a more or less dense fringe of long hairs on upper sheath margin and auricles of the upper leaves; ligule a thin membrane 1 to 2 mm long, the collar prominent; leaf blades linear-lanceolate, *the major central or lower ones 40 to 80 cm long, 4 to 5 cm wide*, subcordate, glabrous, or subglabrous, except for a few marginal long hairs near base.

Male inflorescences with (2 to) 3 to 13 ± divergent to nodding branches; these 6 to 15 cm long, 12 to 20 mm wide, the central one barely exceeding the others; branching axis 1 to 4 cm long; spikelets in sessile or pedicellate pairs (pedicels 1.5 to 3 mm long), crowded and overlapping (for example, 14 spikelet pairs in 4 cm); the branch internodes short (2 to 6 mm); the branch rachis about 1 mm wide, in cross-section triangular with ciliate edges; spikelets 8.5 to 11.5 mm long, about 3 mm wide; outer glumes very thin and translucent, often purple-

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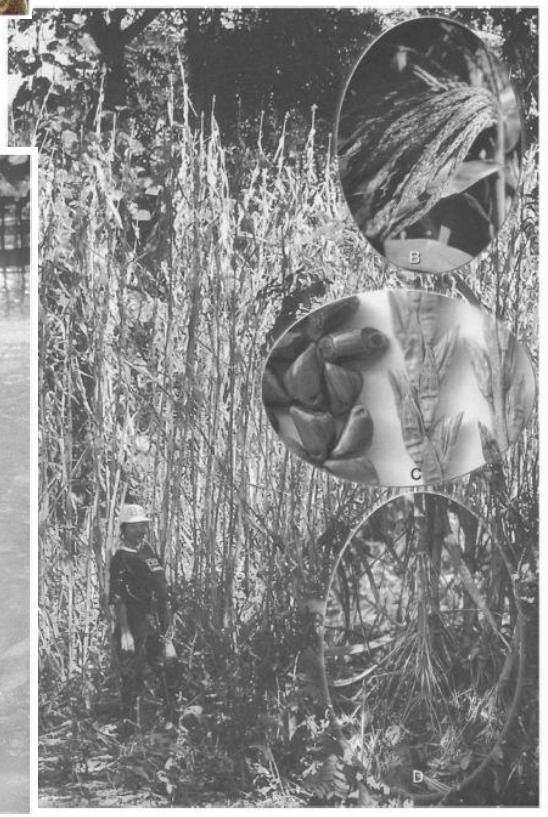
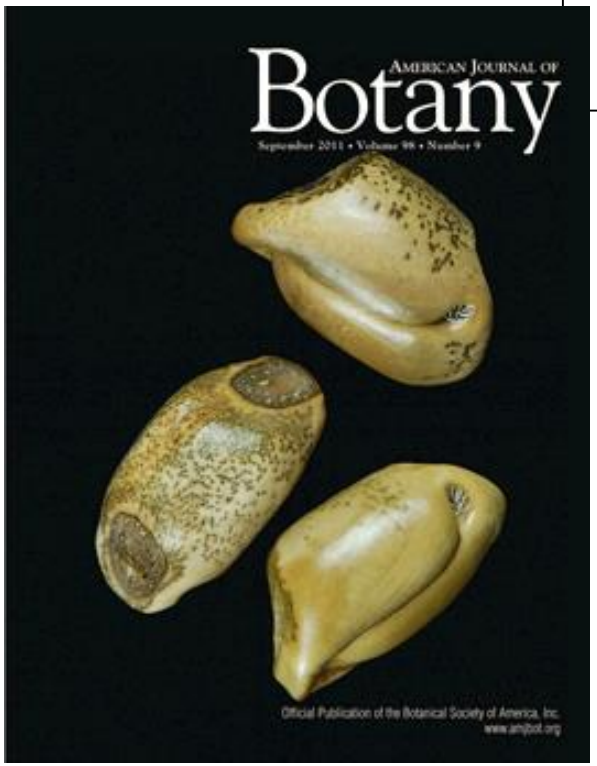
Downloaded from www.sciencemag.org on September 30, 2011



2000 - Hugh Iltis & the discovery of *Zea nicaraguensis*, 0-20m, Pacific coastal Nicaragua
Iltis & Benz (2000) *Novon*

Wild maize makes more headlines in 2011

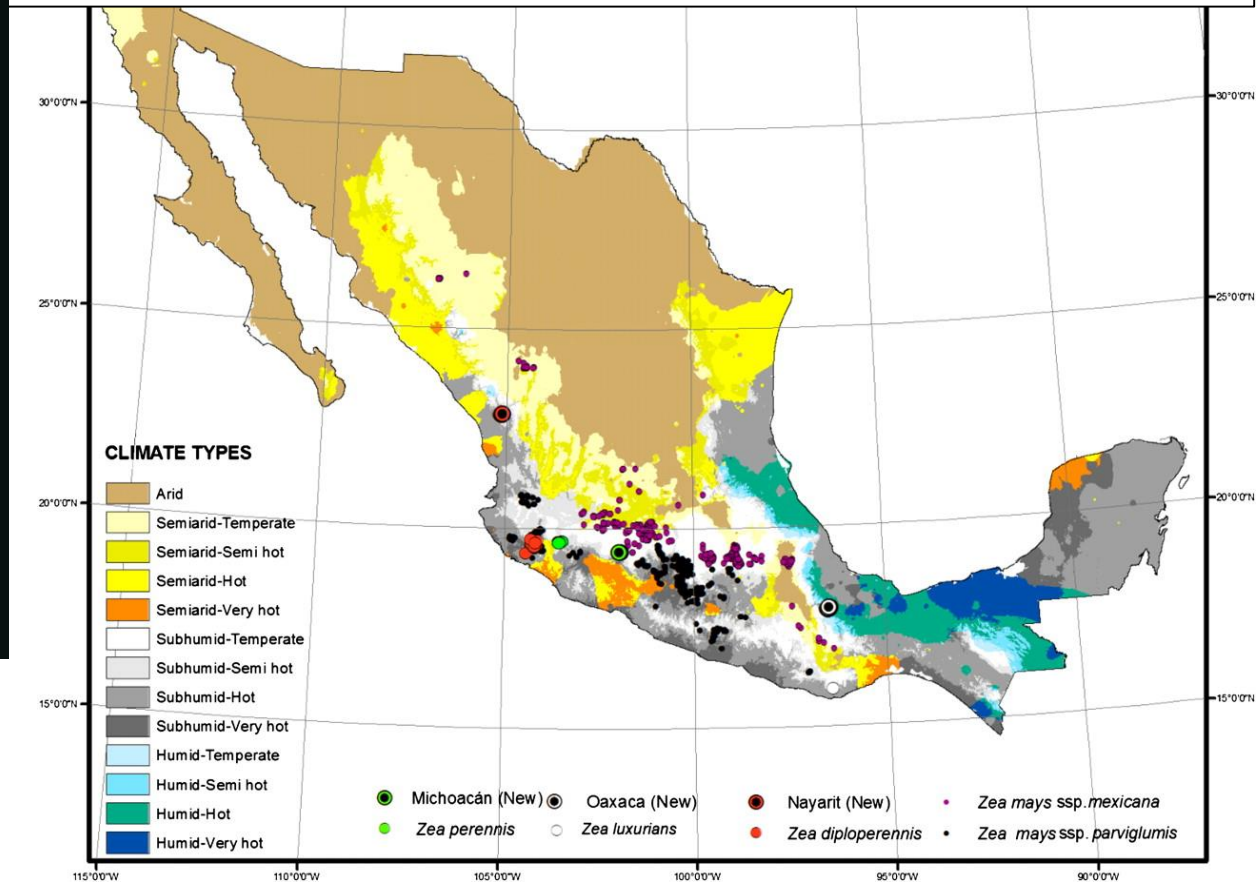


American Journal of Botany
American Journal of Botany 98(9): 1537–1548. 2011.

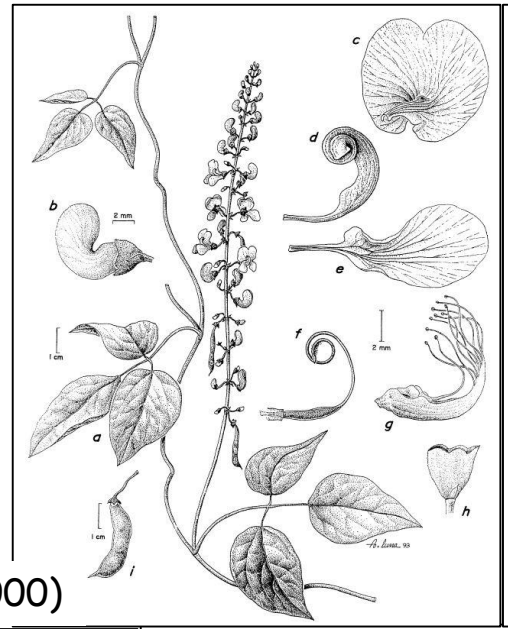
Three new teosintes (*Zea* spp., Poaceae) from México[1]

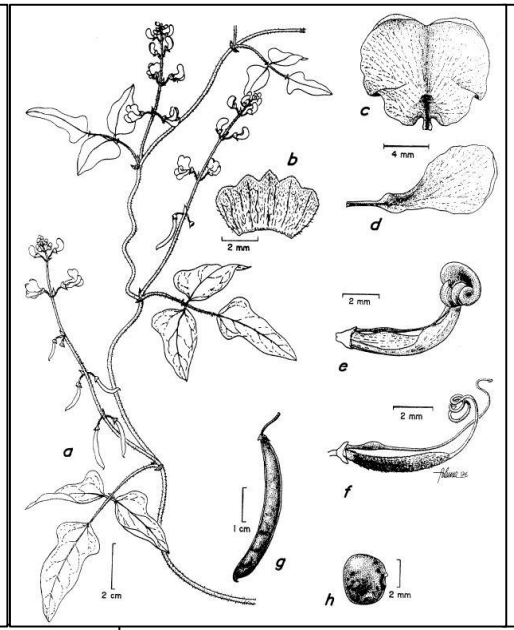
J. J. Sánchez G.[2], L. De La Cruz L.[2], V. A. Vidal M.[4], J. Ron P.[2], S. Taba[3], F. Santacruz-Ruvalcaba[2], S. Sood[5], J. B. Holland[5], J. A. Ruíz C.[4], S. Carvajal[2], F. Aragón C.[4], V. H. Chávez T.[3], M. M. Morales R.[2], and R. Barba-González[6]

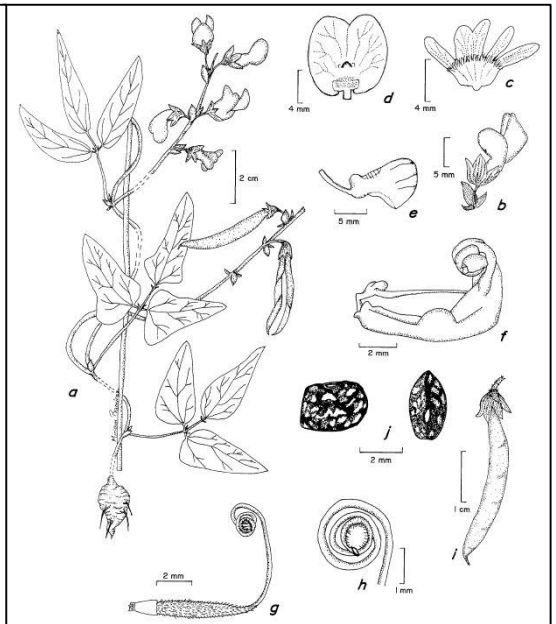
[2]Centro Universitario de Ciencias Biológicas y Agropecuarias, Universidad de Guadalajara. Km. 15.5 Carretera Guadalajara-Nogales, C.P. 45110. Las Agujas, Zapopan, Jalisco, México; [3]Centro Internacional de Mejoramiento de Maíz y Trigo, Unidad de Recursos Genéticos, Apartado Postal 6-641 06600 México, D.F. México; [4]Instituto Nacional de Investigaciones Forestales Agrícolas y Pecuarias, Parque Los Colomos S/N, Col. Providencia, Guadalajara 44660 Jalisco, México; [5]USDA-ARS Plant Science Research Unit, Department of Crop Science, Box 7620, North Carolina State University, Raleigh, North Carolina 27695-7620 USA; and [6]Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco A.C., Av. Normalistas No. 800, Col. Colinas de la Normal, CP 44270 Guadalajara, Jalisco, México



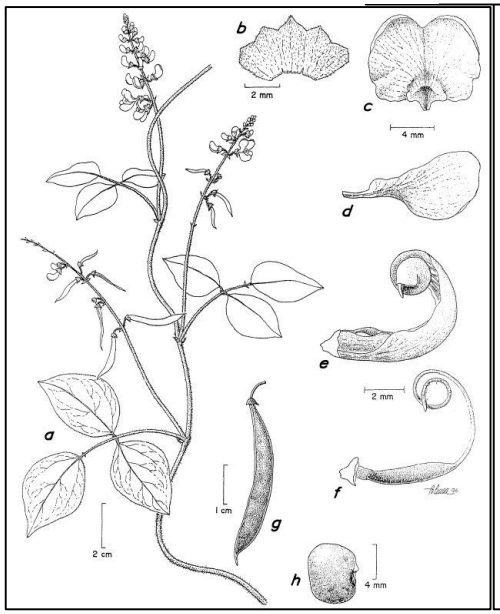
Seven new species of *Phaseolus* from Mexico in 2000

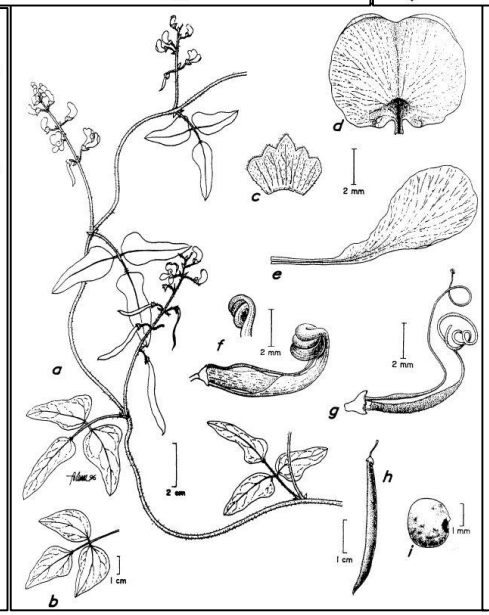


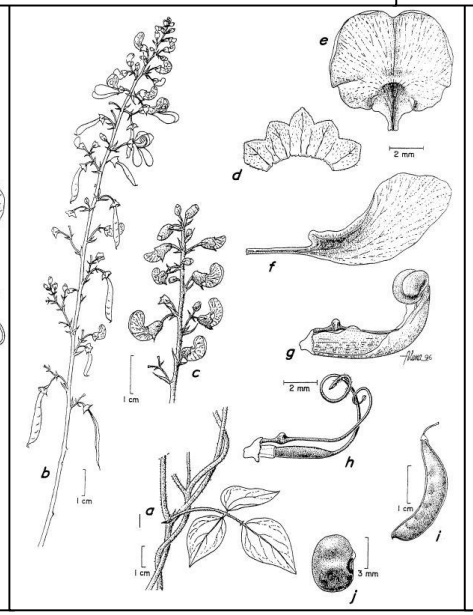


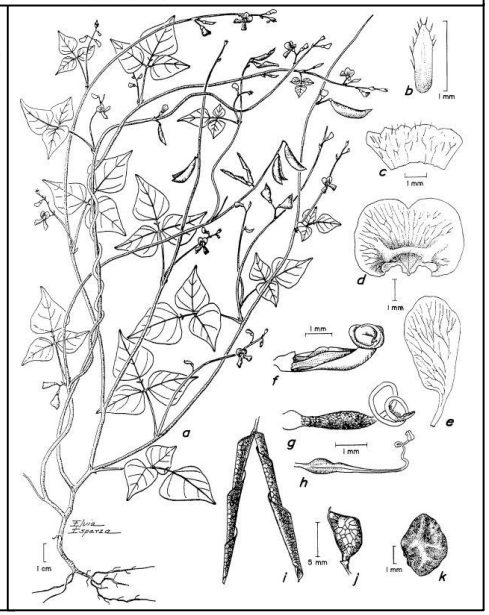


Delgado-Salinas (2000)



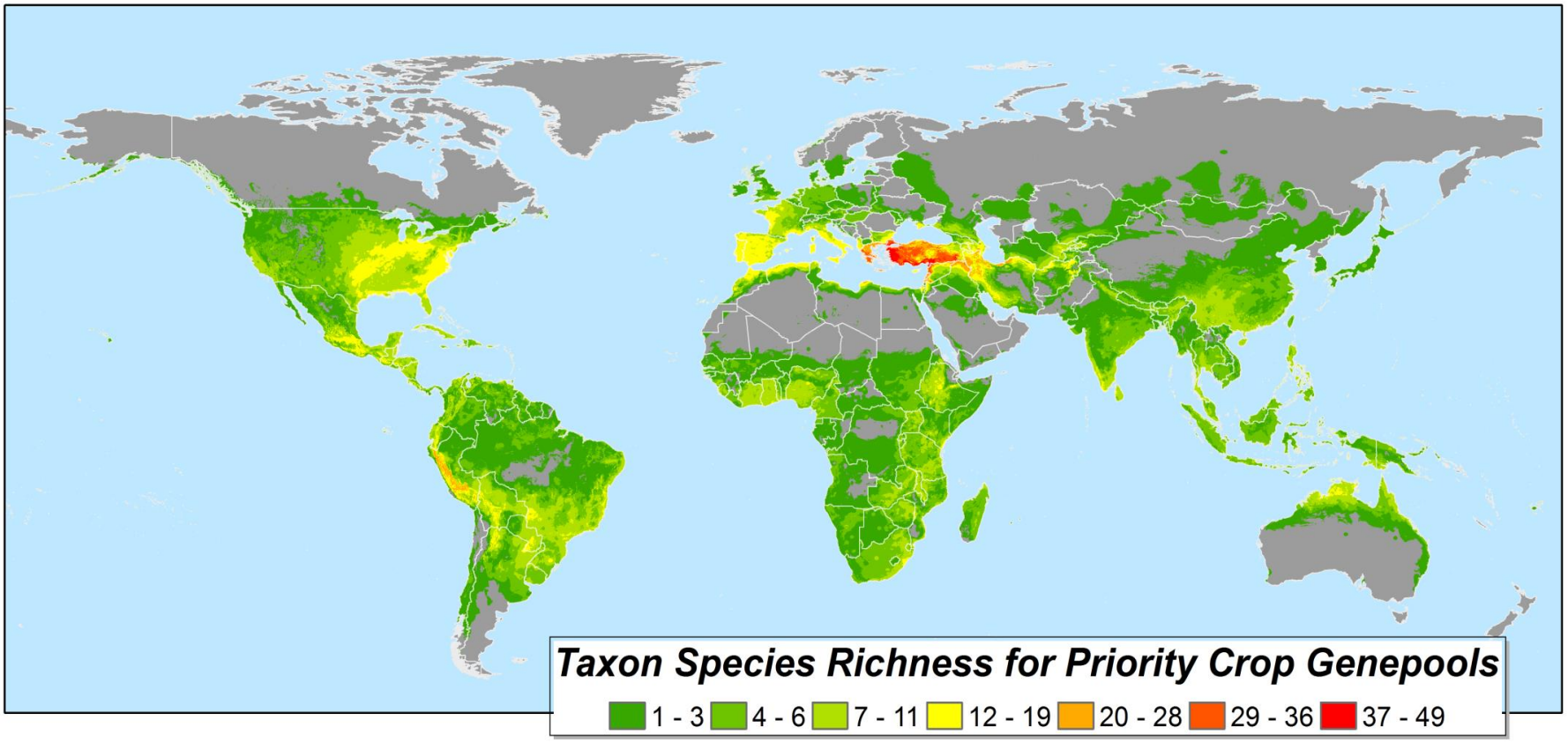






The global richness of Crop Wild Relatives

Adapting agriculture to climate change:
collecting, protecting and preparing crop wild relatives



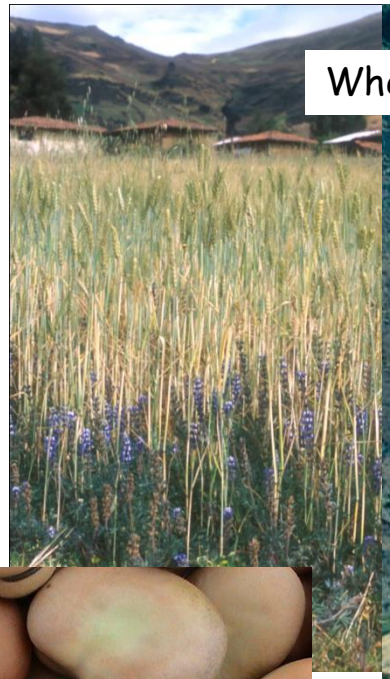
Erosion and Loss of Crop Genetic Resources

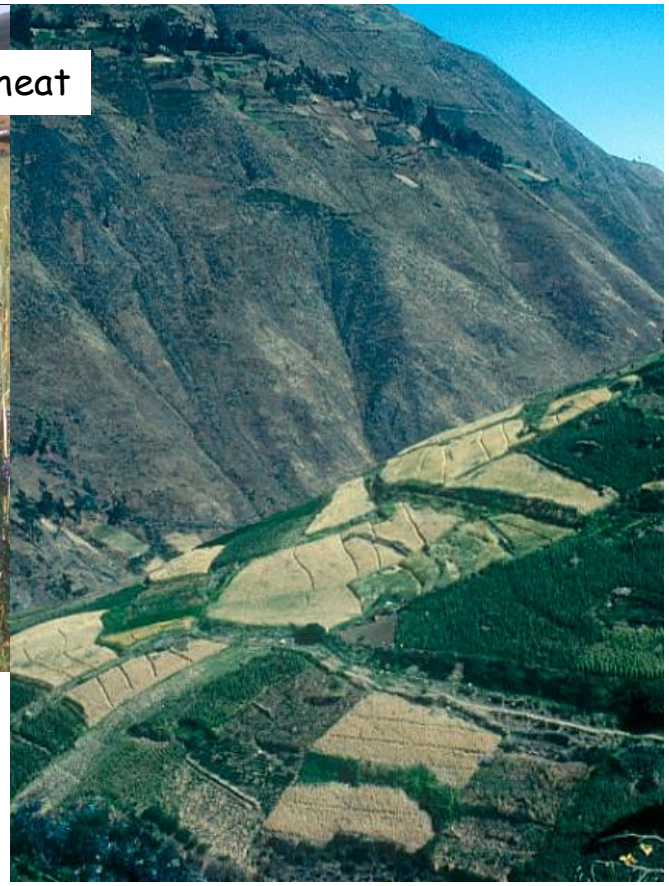
75% of crop diversity has been lost
One animal breed is lost every month

Modern Agriculture
- simplification
- specialization
- mechanization
- uniformity
- high inputs
- risk management via pesticides, irrigation and fertilizers, globalization
- monocultures

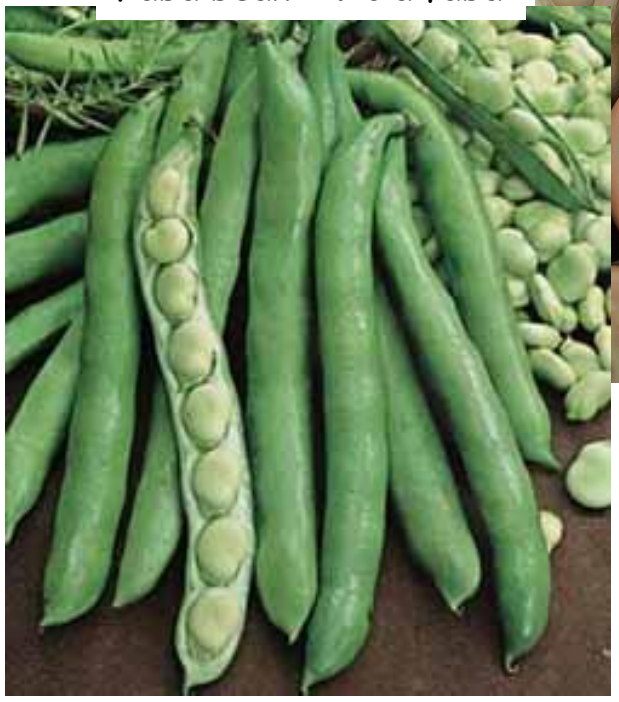
- Modern agriculture is the biggest threat to crop genetic resources – i.e. the advances in modern agriculture are destroying the very resources upon which future crop breeding depends.

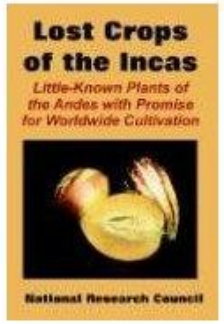
Wheat





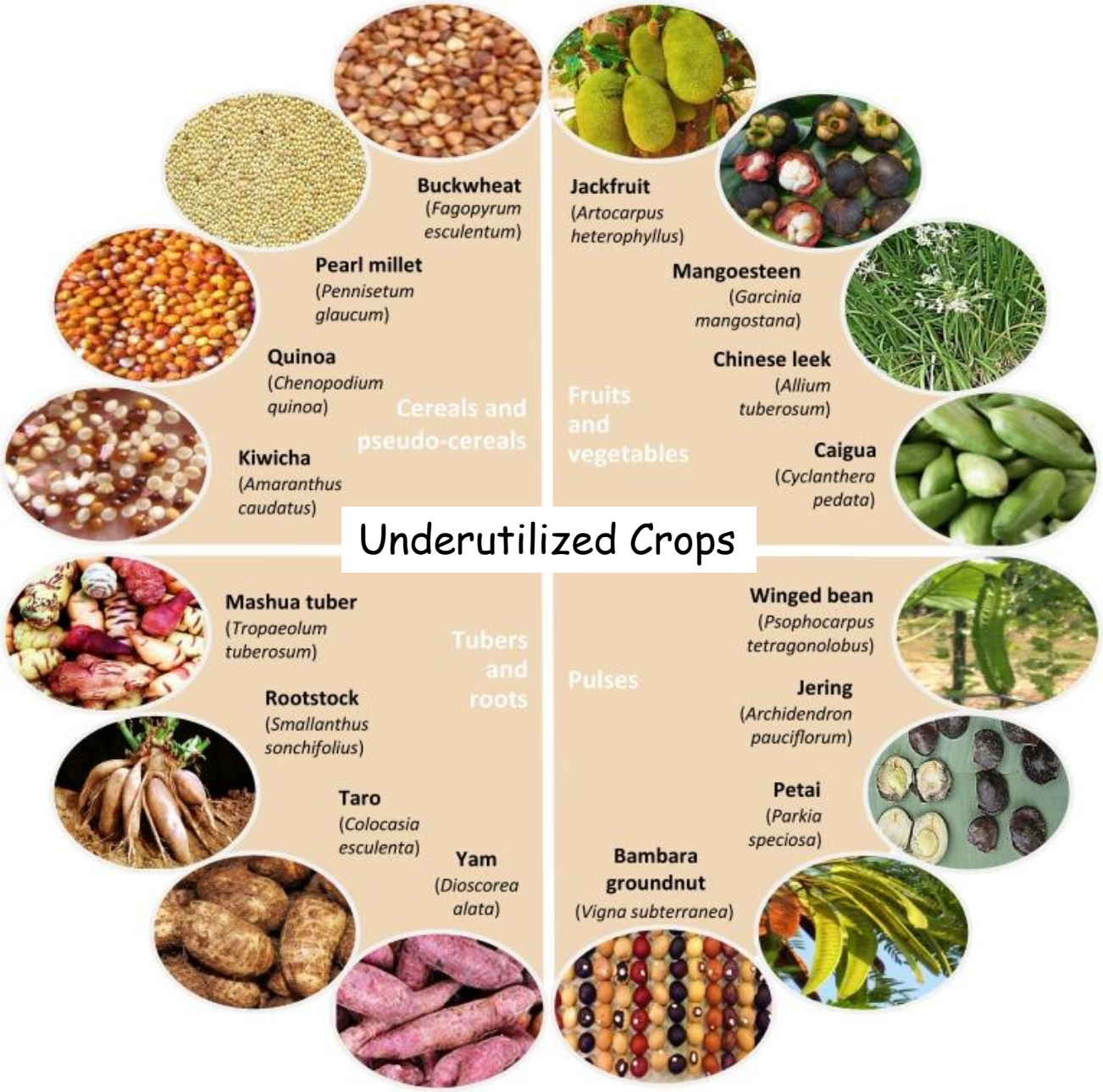
Faba bean – Vicia faba





Lost Crops of the Incas - *Little-Known Plants of the Andes with Promise for Worldwide Cultivation.*

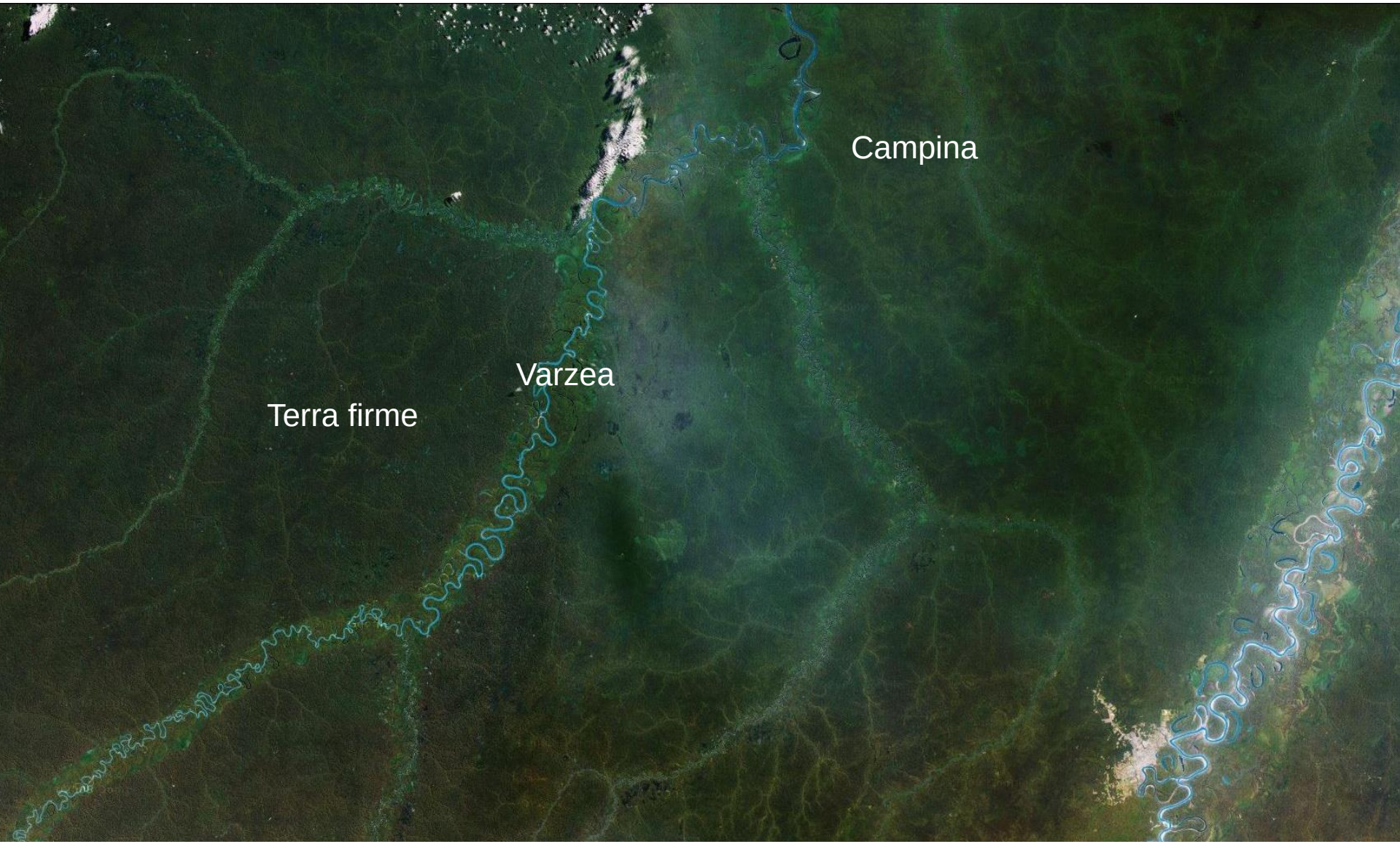
Displacement of indigenous Andean crops by Old World crops, such as wheat and broad beans introduced by the Spanish in th 17th Century. These now taking over from Quinoa and Tarwi.



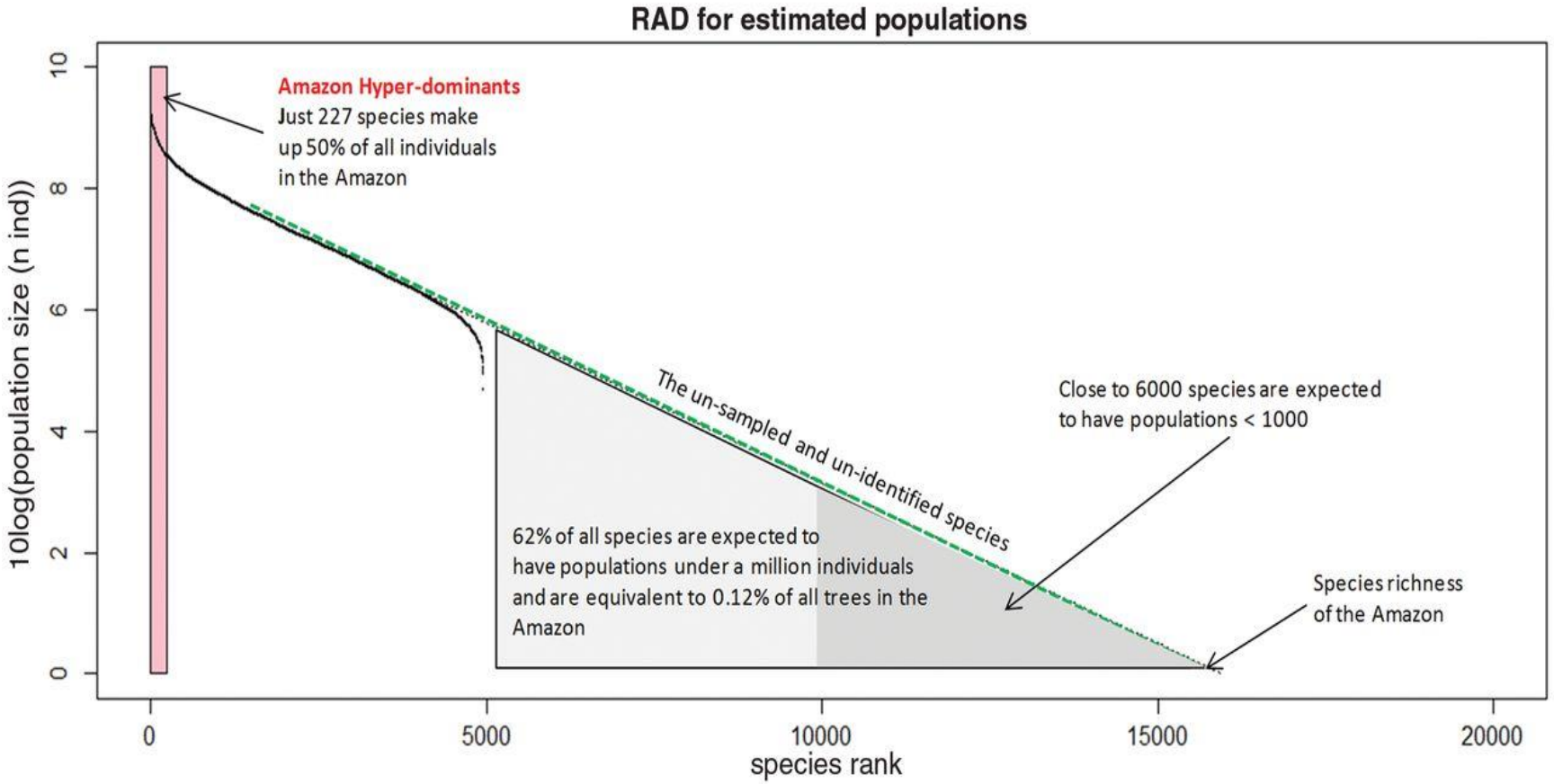
Massawe et al (2016)

Potato
Solanum tuberosum
Solanaceae


The Amazonian Rain Forest

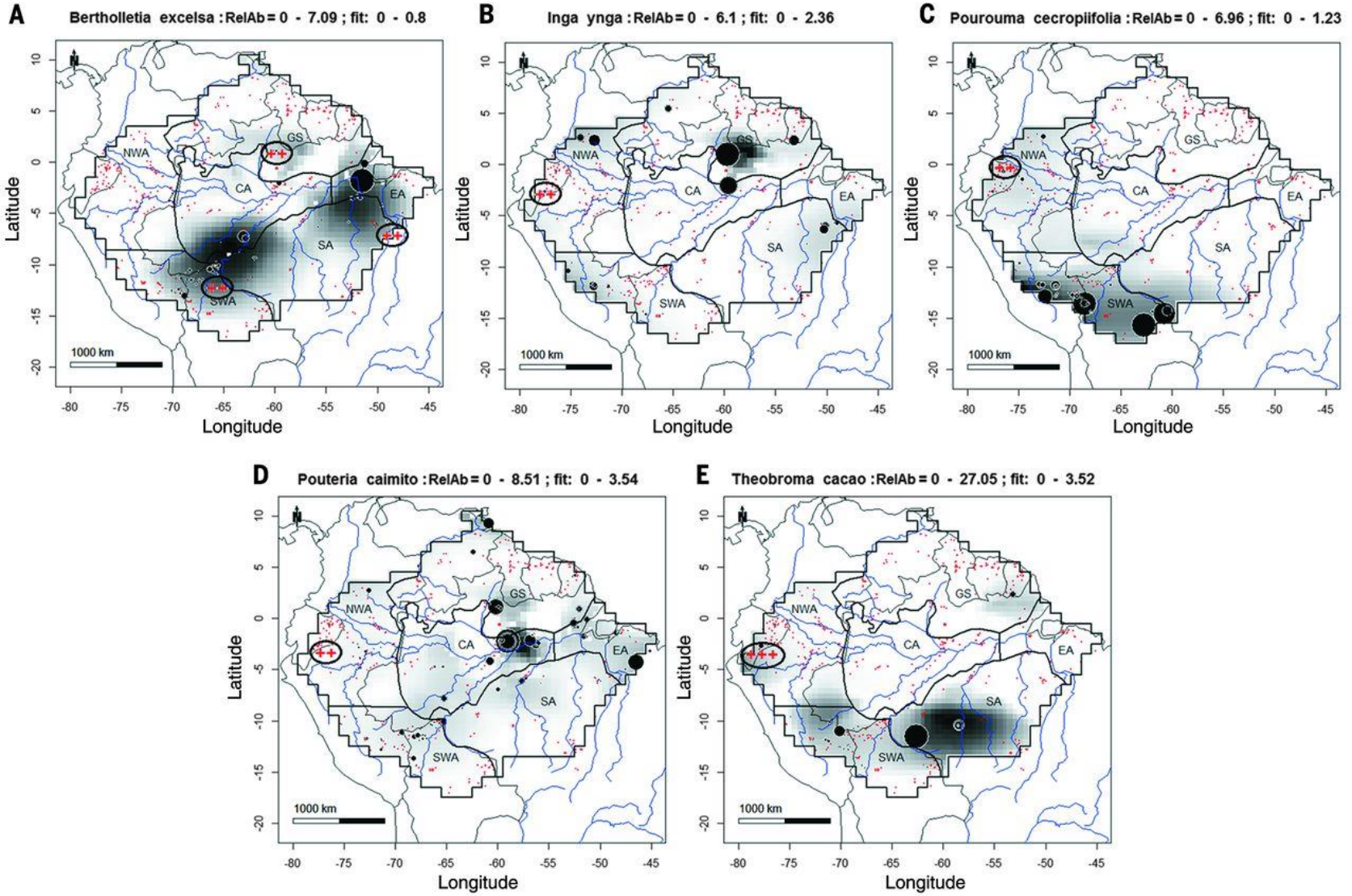

Campina
Varzea
Terra firme

Hyperdominance and rarity in the Amazonian tree flora



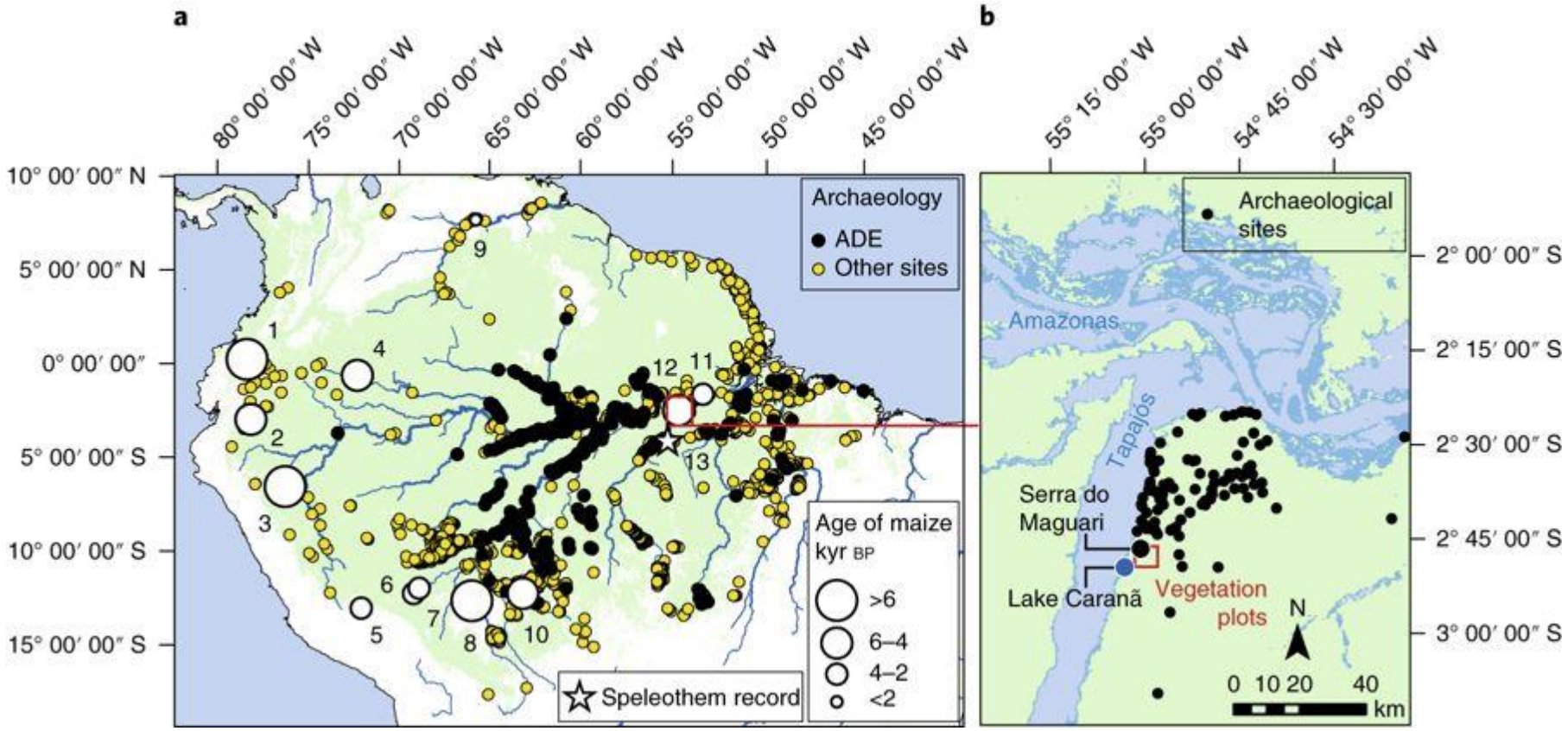
Ter Steege et al (2013)

Hyperdominance of domesticated tree species in the Amazon



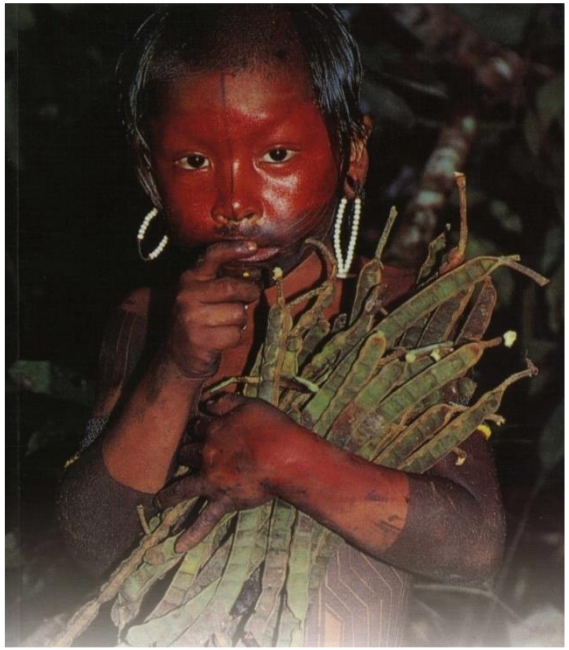
Levis et al (2017)

Amazonian Dark Earth Anthropogenic soils and early Amazonian maize cultivation



Maezumi et al. (2018)

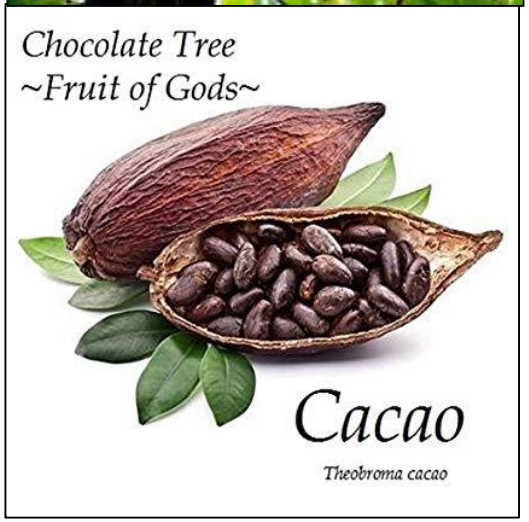
Bactris grasipes – Pejibaye – Peach Palm



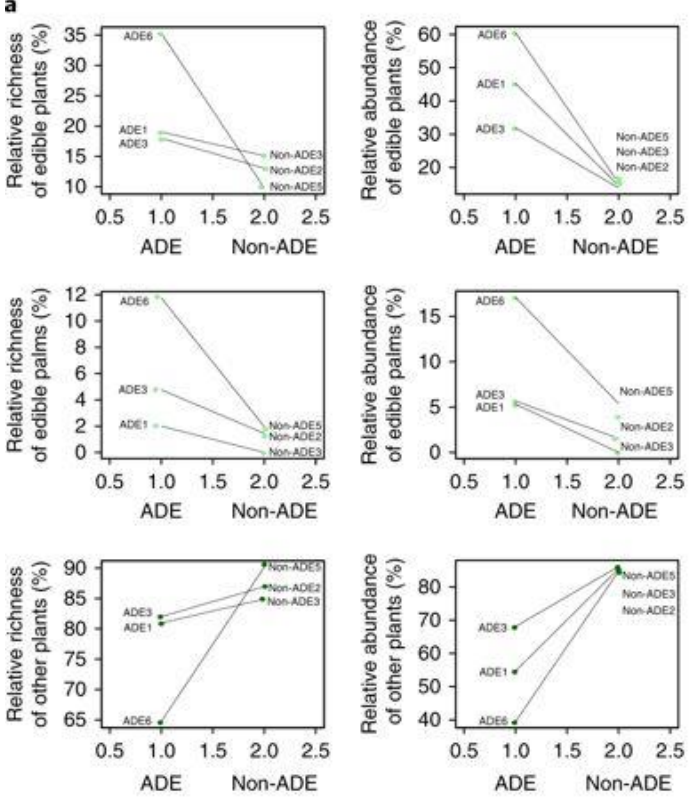
Inga spp. – Ice cream bean

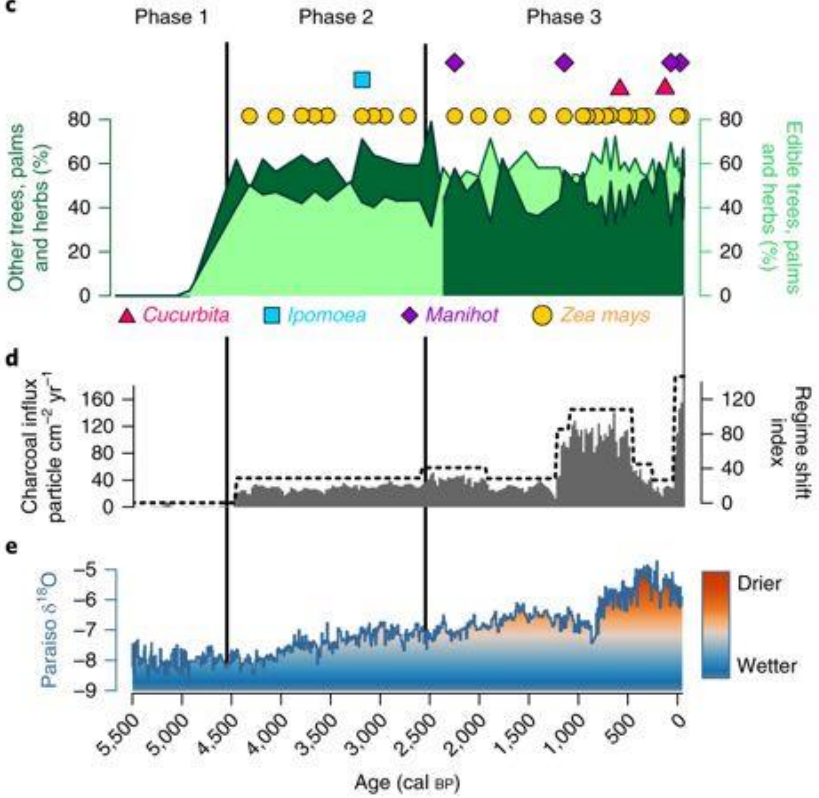
Bertholettia excelsa – brazil nut

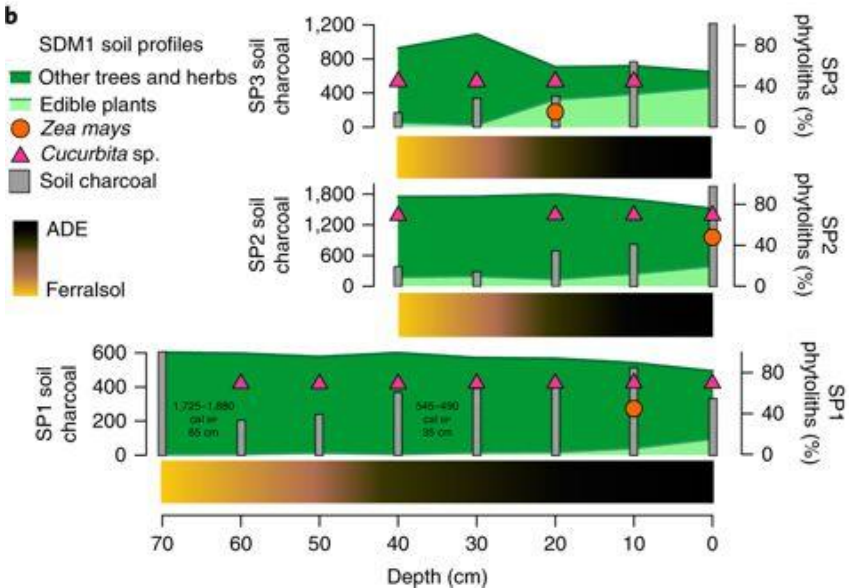
Pouteria caimito – abiu

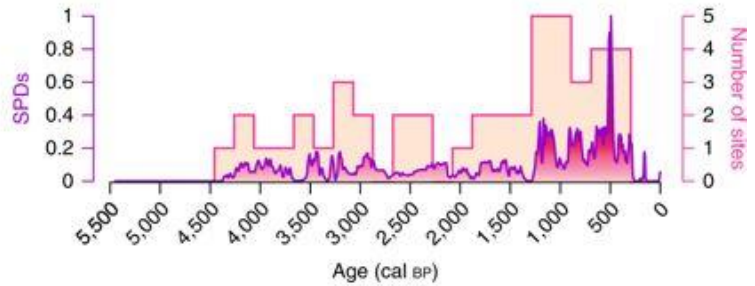


Theobroma cacao





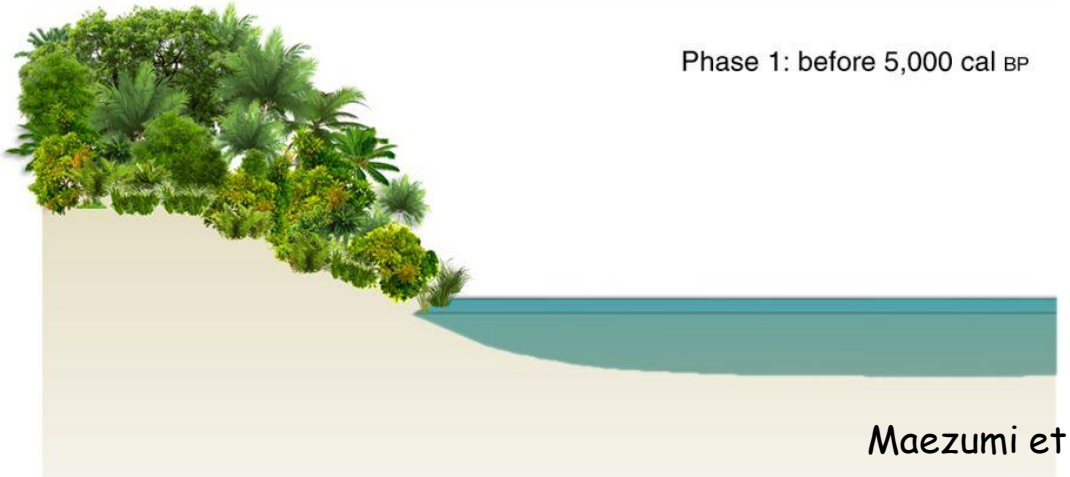




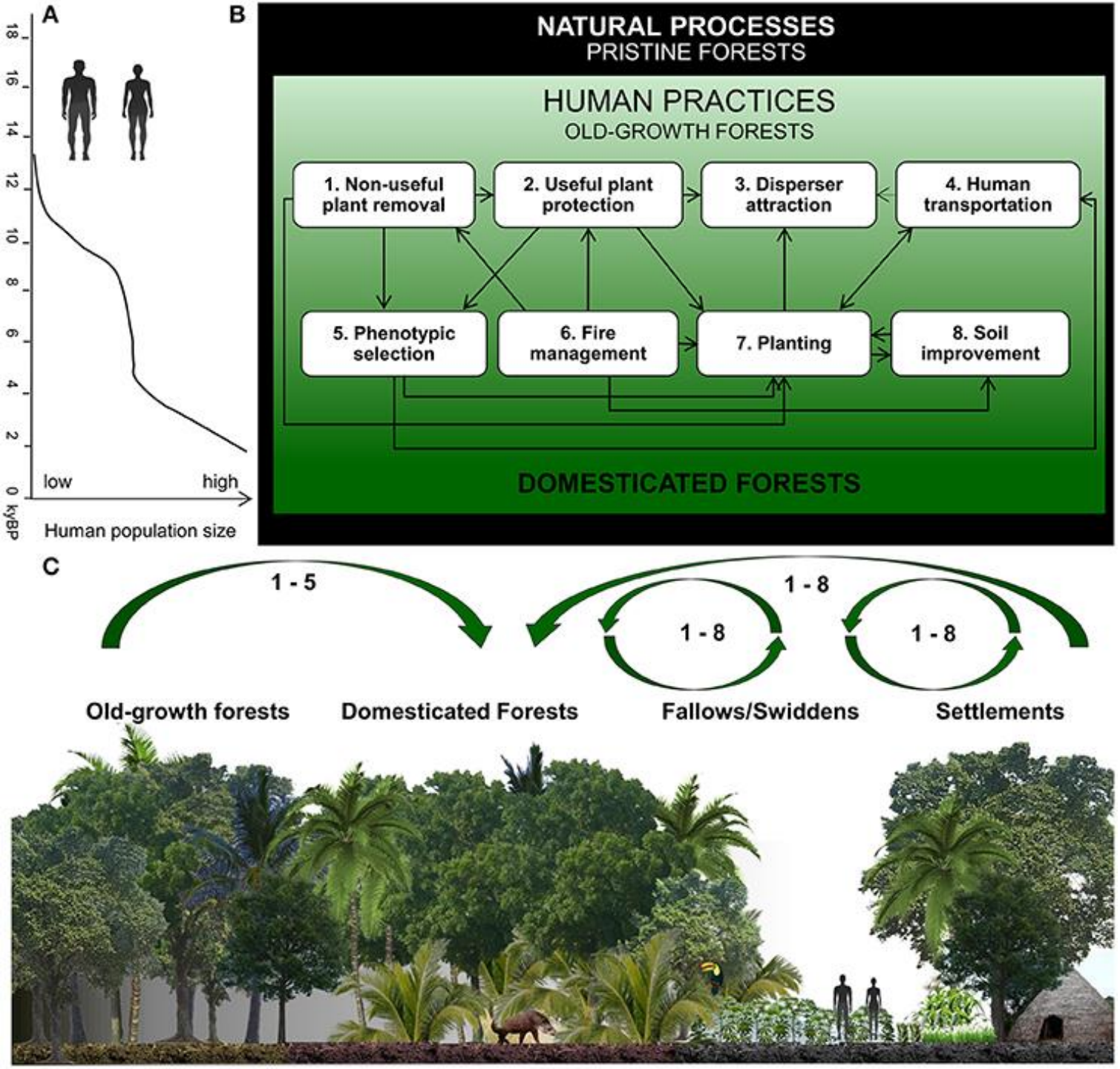
Domestication of the Amazon

Maezumi et al. (2018)

Amazonian polyculture agroforestry

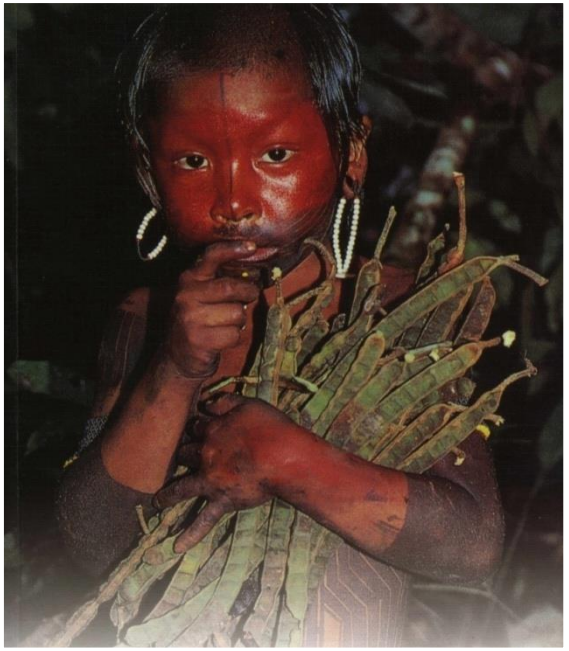


Maezumi et al. (2018)



Levis et al. (2018)

1492 and the Loss of Amazonian Crop Genetic Resources



- 1492 - 4-5 million people lived in Amazonia
- at least 138 plant species at that time.
- Demographic collapse of Amazonian Amerindian population to around 0.5 million.
- Concomitant decline in Amazonian crop genetic diversity
- An order of magnitude loss of crop genetic resources that is continuing today.

Bactris grasipes – Pejibaye – Peach Palm

nature ecology & evolution

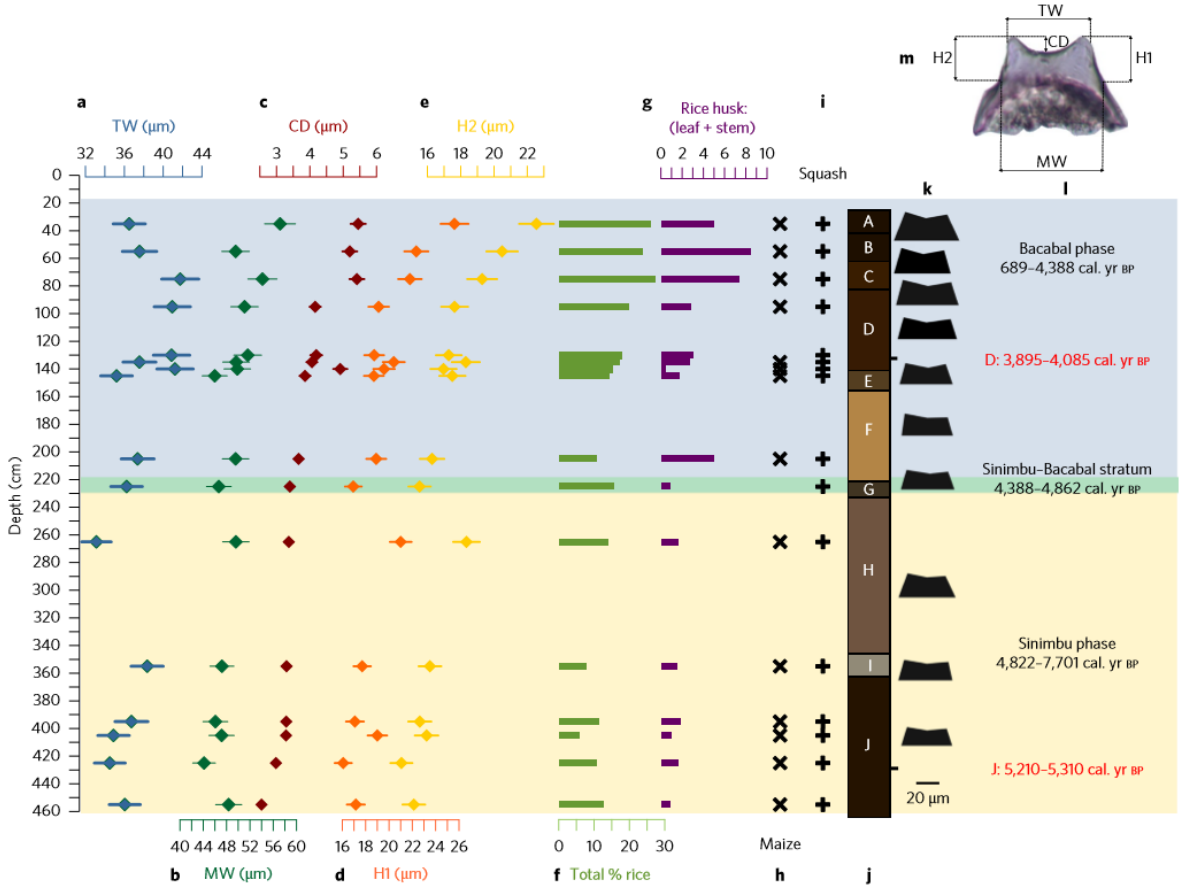
ARTICLES

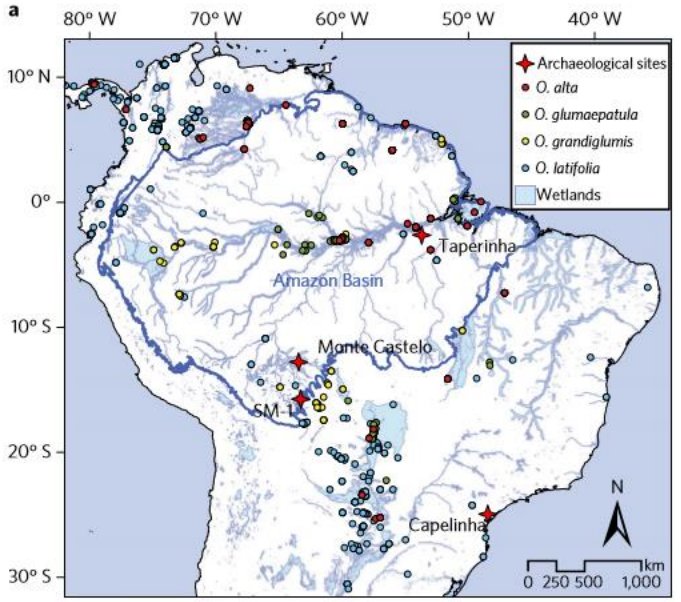
DOI: 10.1038/s41559-017-0322-4

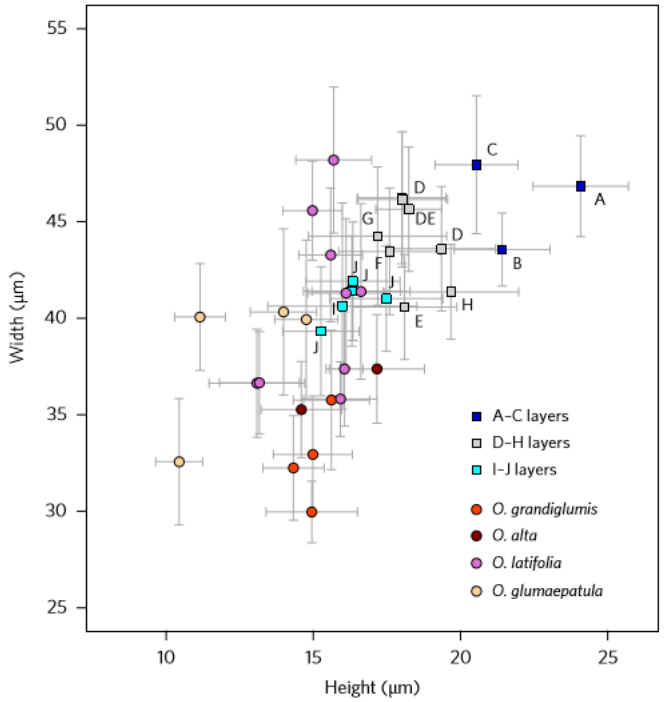
Evidence for mid-Holocene rice domestication in the Americas

Lautaro Hilbert[1], Eduardo Góes Neves[2], Francisco Pugliese[2], Bronwen S. Whitney[3], Myrtle Shock[4], Elizabeth Veasey[5], Carlos Augusto Zimpel[6] and José Iriarte[1*]

November 2017







nature plants

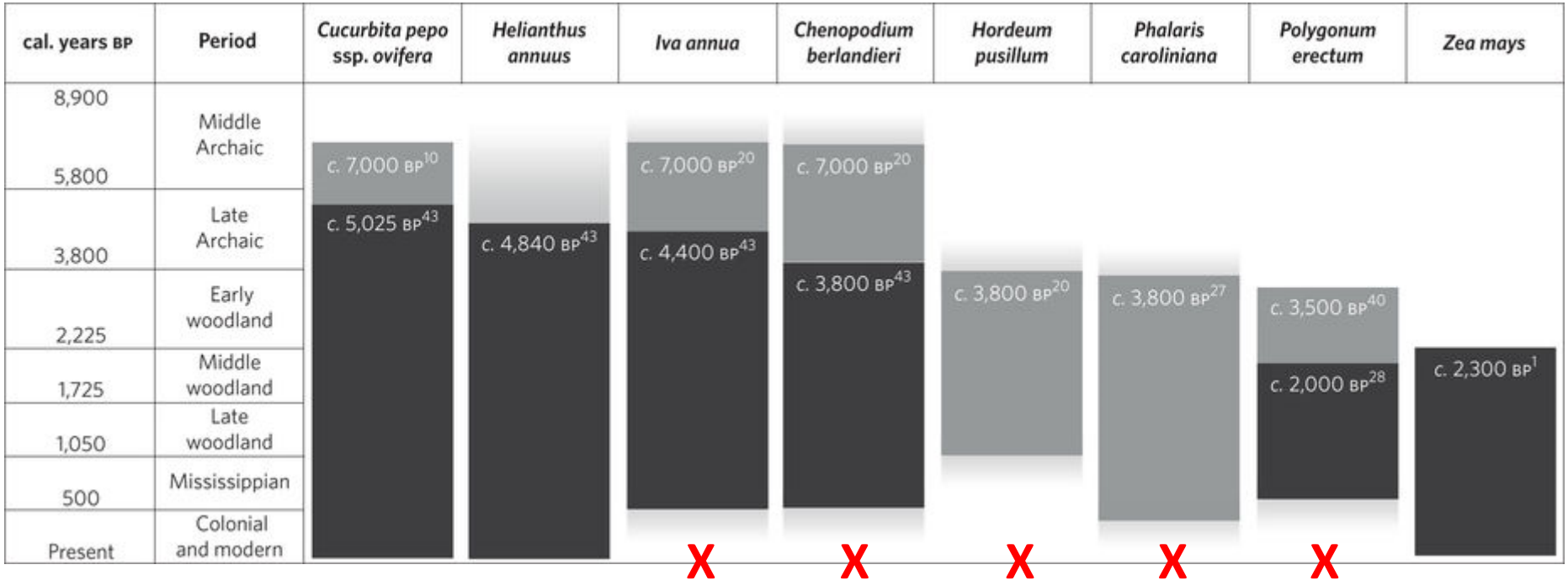
PERSPECTIVE

PUBLISHED: 5 JULY 2017 | VOLUME: 3 | ARTICLE NUMBER: 17092

Growing the lost crops of eastern North America's original agricultural system

Natalie G. Mueller[1]*, Gayle J. Fritz[1], Paul Patton[2], Stephen Carmody[3] and Elizabeth T. Horton[4]

a. Goosefoot – *Chenopodium berlandieri*
b. Sumpweed / Marsh Elder – *Iva annua*
c. Little Barley – *Hordeum pusillum*
d. Erect Knotweed – *Polygonum erectum*
e. Maygrass – *Phalaris carolinum*



Lost Crops of eastern North America

Polygonum erectum – largely replaced by invasive Eurasian *P. aviculare*

Phalaris carolina – under threat from expanded herbicide use and elimination of field margins

Chenopodium berlandieri threatened by herbicides used to target goosefoot in agricultural fields and spread of herbicide-resistant Eurasian *C. album*

nature plants

PERSPECTIVE

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3 of the 5 relict ENA crops are now rare due to:
- Competition from their invasive cousins
- Shrinking field margins
- Increased herbicide use

These species are disappearing from increasingly homogeneous and intensively cultivated agricultural landscapes where they were once common

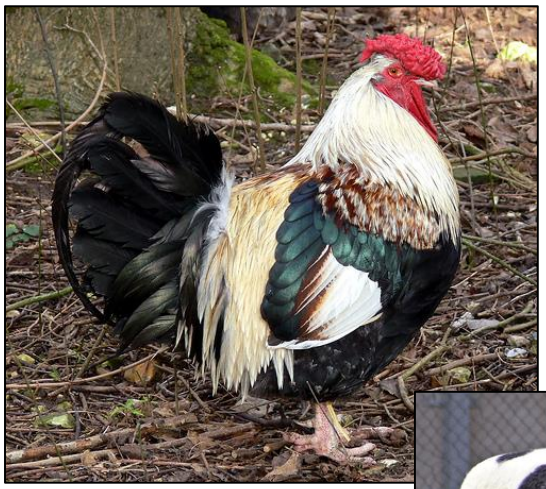
Symptomatic of global loss of biodiversity in and around agroecosystems related to agricultural intensification

Lost Crops Garden Network http://lostcrops.org/

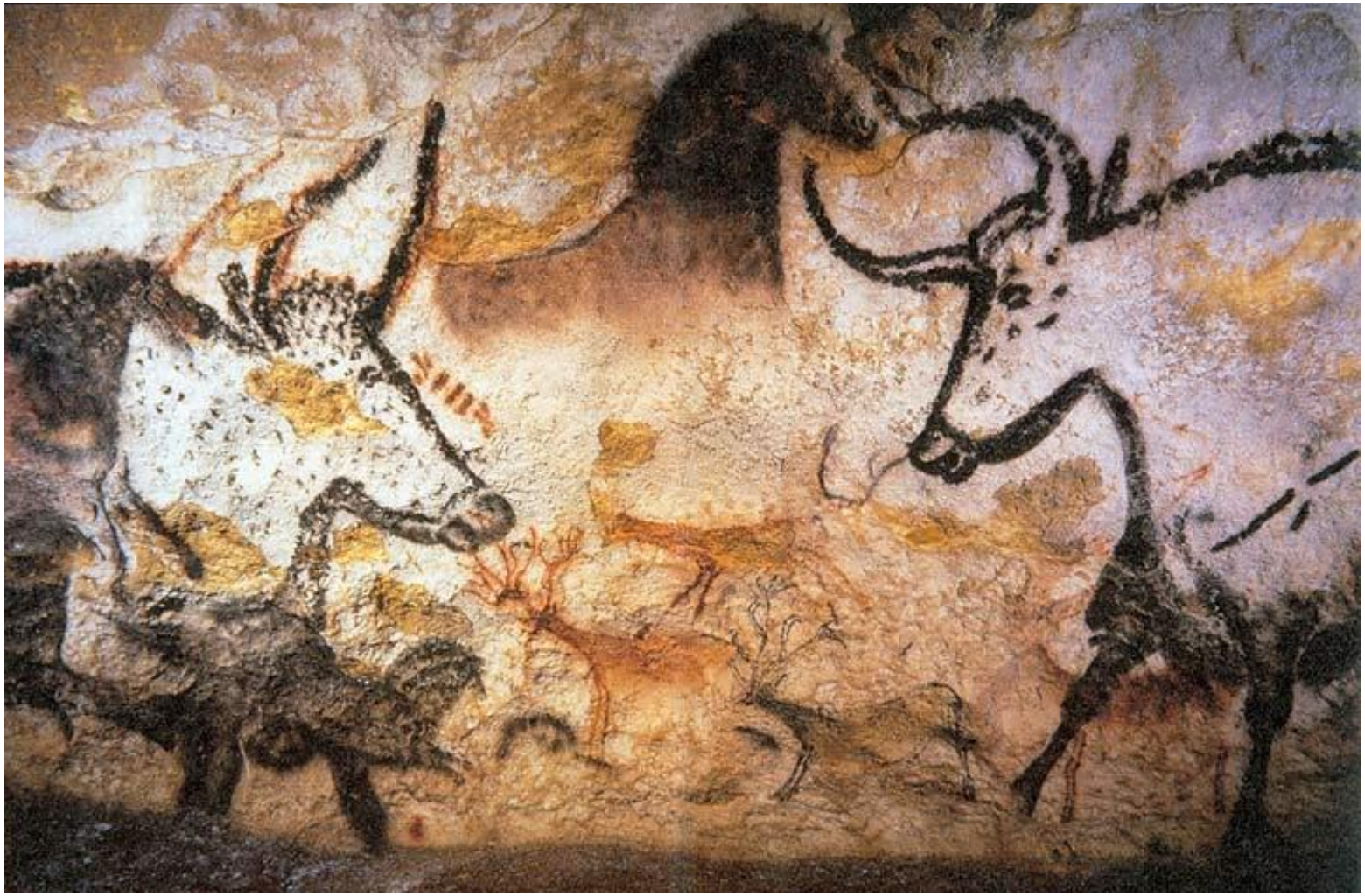
RBST
Rare Breeds Survival Trust

Throughout the world one breed of farm animal becomes extinct every month.

Between 1900 and 1973, 26 native breeds of livestock were lost in the UK, in addition to many varieties of poultry. Breeds with evocative names such as the Goonhilly ponies, Somerset Sheeted cattle, Lincolnshire Curly Coated pigs, and Limestone sheep, have all gone. Others are now rare.



The Auroch – an extinct type of wild cattle and thought to be the ancestor of domestic cattle




INTENSIVE FARMING FADES YOUR GENES....
.... DIVERSITY DOESN'T

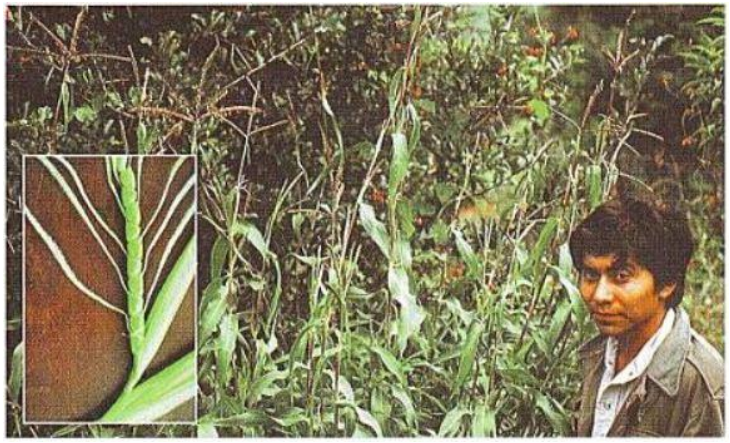
Genetic Conservation

In situ – protection of natural vegetation in biological reserves

Ex situ – longterm seed storage (seed banks) or living collections (botanic gardens, agricultural research centres

Circa-situm = on-farm conservation, farmer-based conservation, conservation *in hortus*, Growing Diversity

'*Use it or lose it*'

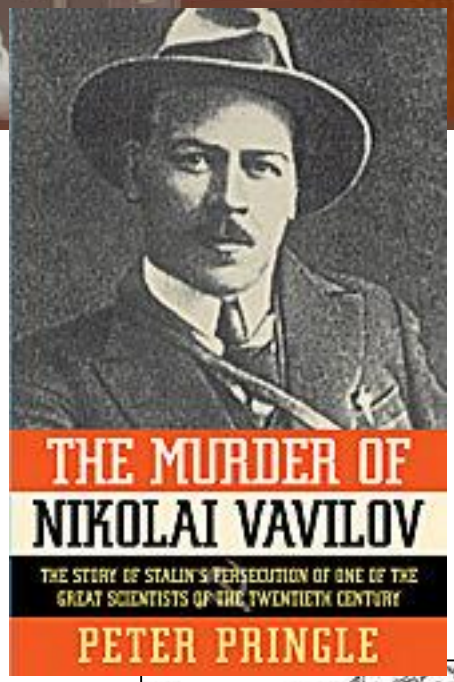


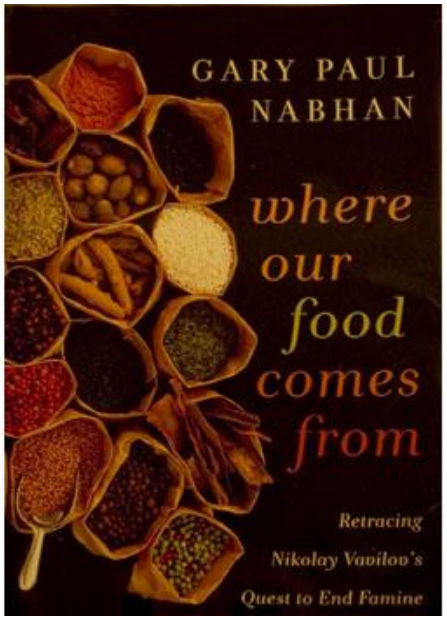
Zea diploperennis and the Sierra de Manantlán Biosphere Reserve

RESERVA DE LA BIOSFERA
SIERRA DE MANANTLÁN

Nikolai Vavilov 1887-1943

vaviblog





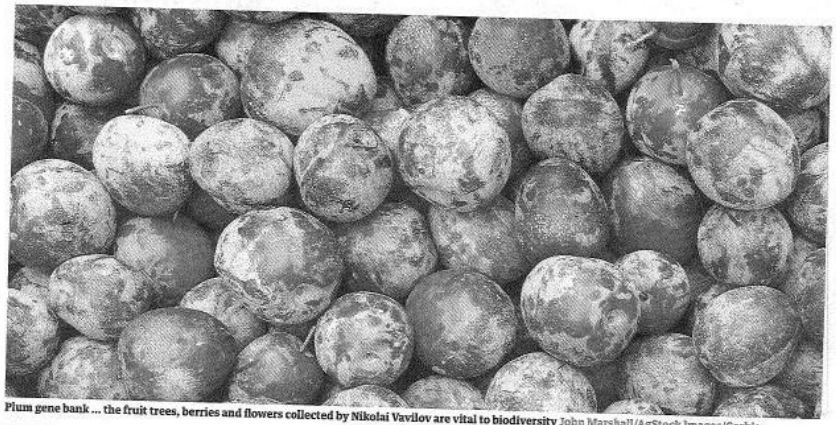
http://www.vaviblog.com/

Vavilov Institute threatened with closure

Millennium Seed Bank, Kew Gardens, London

Weekly review

The fruits of protest



Plum gene bank ... the fruit trees, berries and flowers collected by Nikolai Vavilov are vital to biodiversity John Marshall/AgStock Images/Corbis

Russia has shelved plans to break up the historic Pavlovsk seed bank, writes *Marie Jégo*

The Vavilov gardens sprawl down an exposed, gently sloping hill: 500 hectares of fertile soil planted with fruit trees, berries and flowers. This haven of biodiversity is located near Pavlovsk, about 30km south of St Petersburg, the site of a palace where tsar Paul I (1754-1801) liked to spend the summer. Hidden behind rusty fences and rampant weeds, the garden with its 12,000 plant species is an extraordinary place. It is the "open-air gene bank" for the Institute of Plant Industry founded in 1926 by the geneticist Nikolai Vavilov and based in St Petersburg.

But this unique collection is under threat. A federal housing agency is waiting impatiently for permission to auction off 91 hectares of the precious land, which should sell for about $33m. Developers are eager to make a killing by building cottage-style homes for rich buyers.

The 300-strong staff of the institute are in a state of shock. Since April the federal housing agency has been demanding they move out of the relevant plots. The first auction, due to be held on 23 September, has been postponed until at least the end of this month after widespread protests. "It makes me sick to think the bulldozers are going to destroy my collection of plum trees," says Olga Radchenko, a slim woman with spectacles, wearing a lab coat and gumboots.

Each scientist at the gardens is in charge of a collection. Radchenko takes care of 370 different varieties of plum. From her home in the city she has a long journey to work every day (two hours by bus, subway, suburban train and another bus). Her colleague Natalia Poupkova is responsible for 300 types of gooseberry, and Olga Tikhonova looks after 1,000 varieties of blackcurrant.

Enthusiasm is a key factor here. The wages are pitiful, averaging about $270 per month, equipment is scarce and the administrative building are almost a ruin. City people joke about the botanists and geneticists at the institute being prepared "to fork out to be able to work there".

Public opinion has recently started to take an interest in the fate of the Pavlovsk gardens. The scientific community, at home and abroad, has also started to make itself heard, with petitions sent to President Dmitry Medvedev. Watched by the cameras of leading television channels, the officials' big German cars drive up in a cloud of dust.

"Here they are! Are they going to look at the collections? Shall we go too?" one woman asks. Her fellow workers tell her to keep quiet as the officials enter the building.

In his office on the first floor Fyodor Mikhovich, the manager of the gardens, is beside himself. He has just returned from Moscow where he had a meeting with the president at the Kremlin. "He told me I should stick to my guns and he'd support me. He suggested I insist on the need to transplant the collections, which would take 10 to 15 years," Mikhovich says excitedly.

He has no time for the people trying to get their hands on the land: "They couldn't care less about us. They just want to line their pockets with no effort at all." As an afterthought, he adds: "I hope I won't get sacked."

Legally speaking, it is quite legitimate to sell part of the land. Under Soviet law there was no concept of land ownership as such and the gardens were entrusted to the institute for its use. In 1995, the state recovered the land, conveying it much later to the housing agency. The scientists at Pavlovsk, their eyes glued to their plants, seem to have been oblivious to this turn of events. In August, a court of arbitration ruled that the agency was legally entitled to take over the land.

But by the end of the month the tide had changed. It all started when Medvedev posted a message on Twitter. Now the auction has been postponed. The idea of scattering houses all over the gardens seemed particular inappropriate in the wake of the unprecedented fires that engulfed much of Russia this summer. Between June and August, 13m hectares of woodland was destroyed, reducing countless trees, plants and flowers to ashes.

Now scientists and conservationists are campaigning to permanently preserve the gardens. "We are hoping against hope. With money like that at stake we just don't count," Poupkova says. **Le Monde**

Pioneer of biodiversity

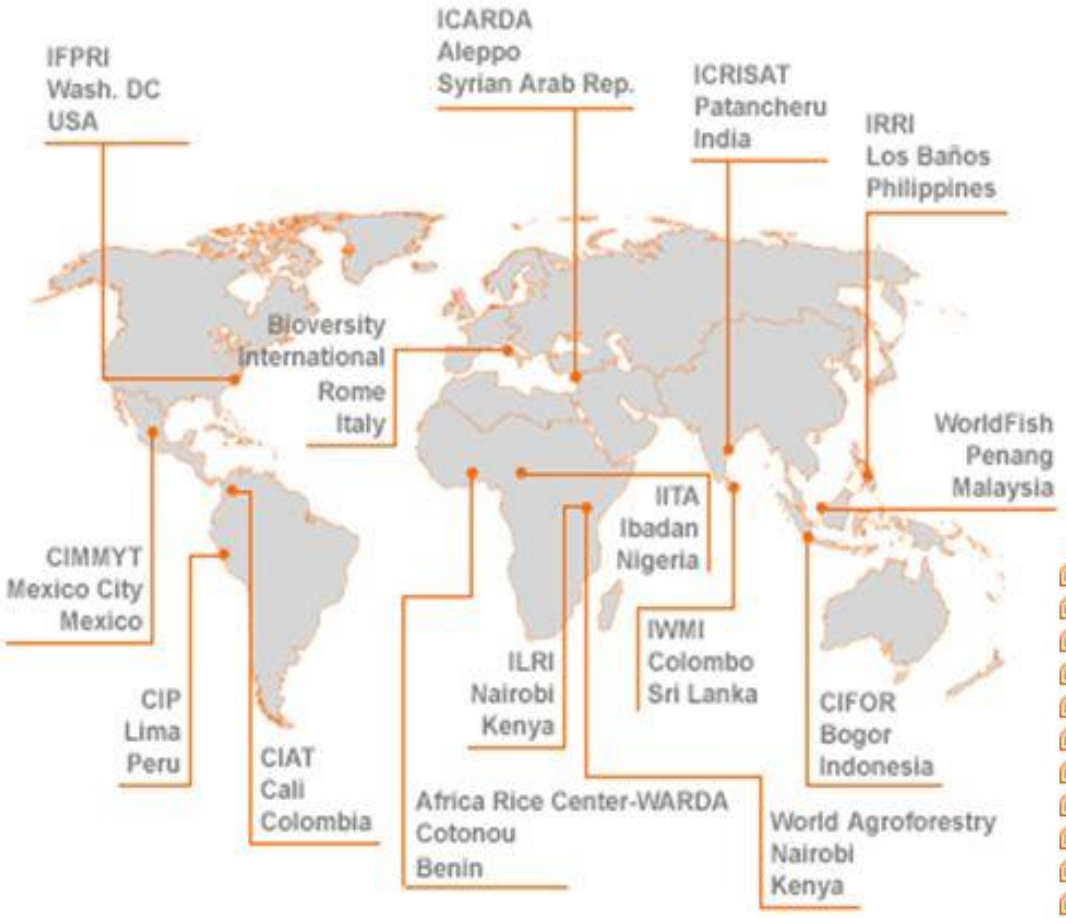
Nikolai Vavilov was born on 13 November 1887 into a family of well-off Muscovite traders. After studying at Moscow Agricultural Institute he made many botanical expeditions to Europe, the United States, Latin America, Iran and Ethiopia.

In 1921 he was appointed head of the (then) Petrograd Agricultural Institute. Realising the importance of biodiversity he set about creating a massive seed bank for wild and cultivated plants. But in 1933 further foreign travel was banned and he was accused of supporting the bourgeois science of genetics.

Vavilov was eventually arrested in 1940. He was tried and condemned to death, but the sentence was commuted to imprisonment at Saratov (on the Volga). There he died of starvation 26 January 1943. **MJ**

15 Oct 2010

30 Sept 2010

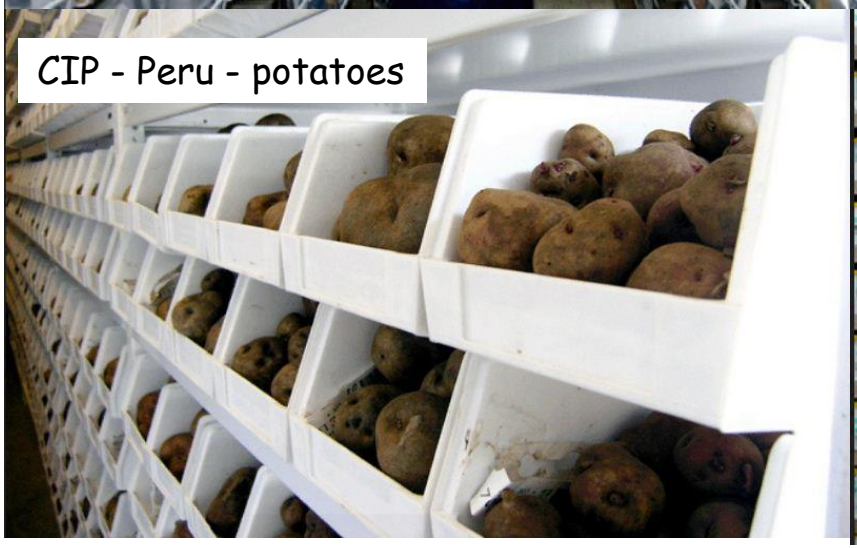


Gene Bank Entries	
Wheat	410,000
Rice	215,000
Maize	100,000
Soybean	100,000
Potato	42,000
Tomato	32,000
Cotton	30,000

- Africa Rice Center
- Bioversity International
- CIAT - Centro Internacional de Agricultura Tropical
- CIFOR - Center for International Forestry Research
- CIMMYT - Centro Internacional de Mejoramiento de Maiz y Trigo
- CIP - Centro Internacional de la Papa
- ICARDA - International Center for Agricultural Research in the Dry Areas
- ICRISAT - International Crops Research Institute for the Semi-Arid Tropics
- IFPRI - International Food Policy Research Institute
- IITA - International Institute of Tropical Agriculture
- ILRI - International Livestock Research Institute
- IRRI - International Rice Research Institute
- IWMI - International Water Management Institute
- World Agroforestry Centre (ICRAF)
- WorldFish Center

IRRI – Philippines - rice

CIMMYT – Mexico – maize + wheat



CIP - Peru - potatoes

ICRISAT – India – millet, sorghum, pulses

Bioversity International uses agricultural biodiversity to improve people's lives.

We carry out global research to seek solutions for three key challenges: Sustainable Agriculture, Nutrition, Conservation.

Previously known as the International Plant Genetic Resources Institute, IPGRI, Rome, Italy

Doomsday Seed Vault, Svalbard

500,000 crop varieties

A global insurance policy, ensuring that a diverse variety of food crops survive threats such as disease, pests, droughts and other natural disasters, and global warming. Harrison (2017)

THE FROZEN ARK

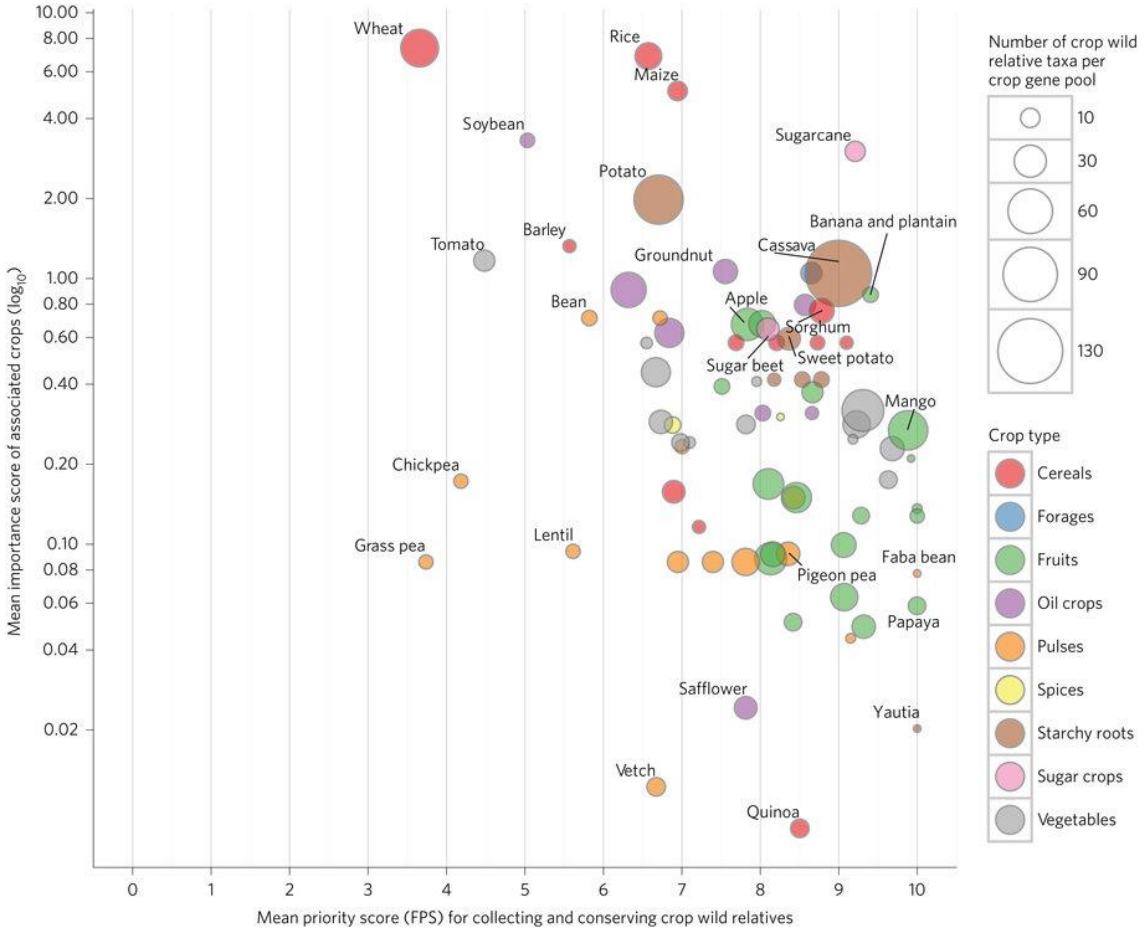
Breithoff & Harrison (2018)

Global conservation priorities for crop wild relatives

1,076 plant species identified as important wild relatives of 81 important crops

313 (29%) species associated with 63 crops not represented in existing germplasm collections

257 (24%) represented by fewer than 10 accessions



Castaneda-Alvarez et al (2016)

Genetic Conservation

In situ – protection of natural vegetation in biological reserves

Ex situ – longterm seed storage (seed banks) or living collections (botanic gardens, agricultural research centres

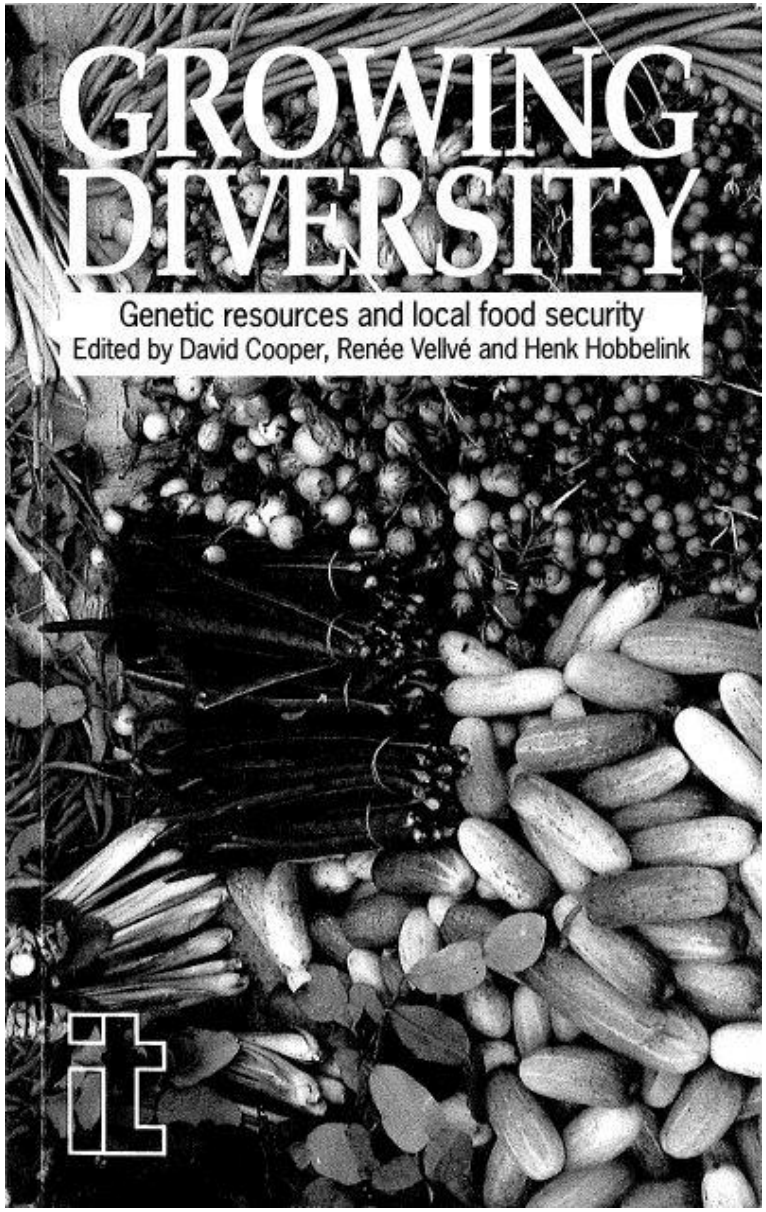
Frozen in time, disconnected from farmers knowledge of crop selection and management inherent in the evolution and development of local cultivars

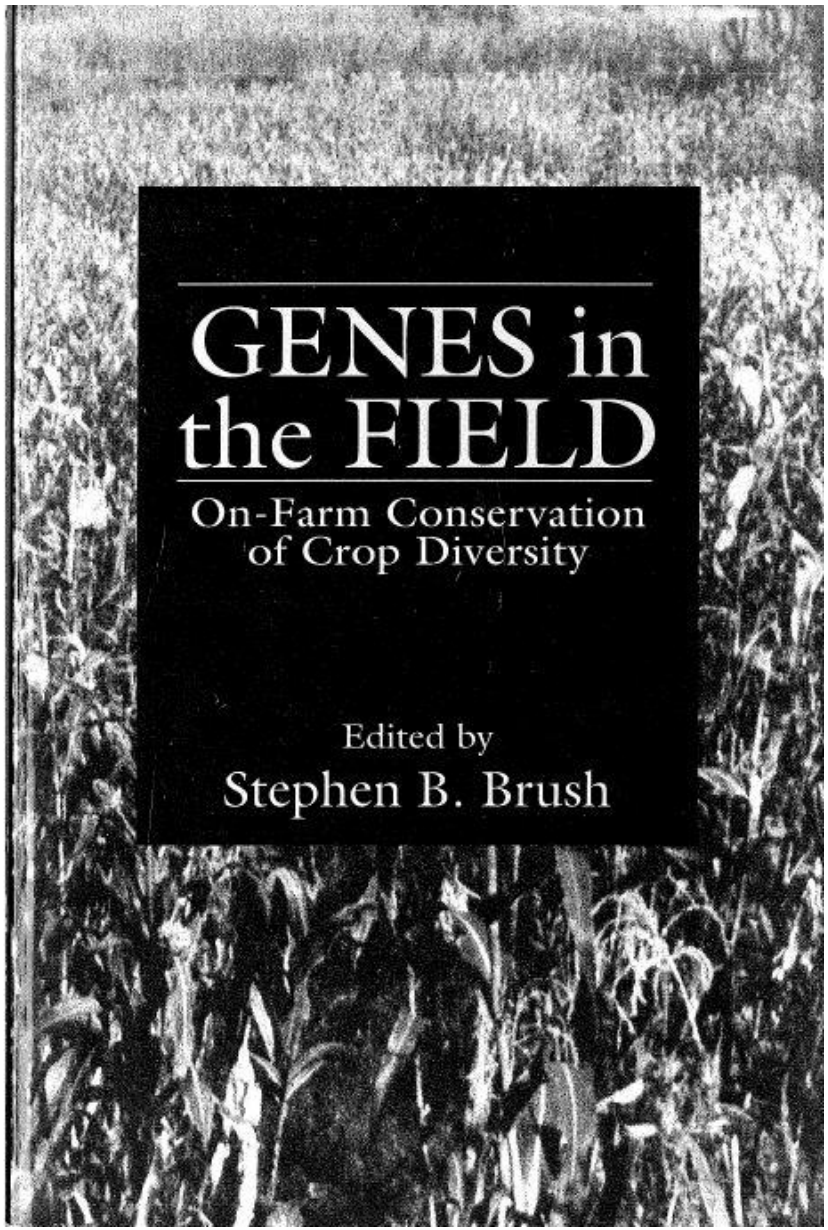
Circa-situm = on-farm conservation, farmer-based conservation, conservation *in hortus*, Growing Diversity

A Living System – Genes in the Field. Farmer management of diversity is itself part of a self-adapting system, e.g. The belief that a named recognizable population is adapted to a particular soil or disease regime, leads to particular actions by farmers based on that belief. This is likely to set up a powerful selection routine that will work to improve that population for the farmers preferred trait, leading to diversification and a self-adapting system

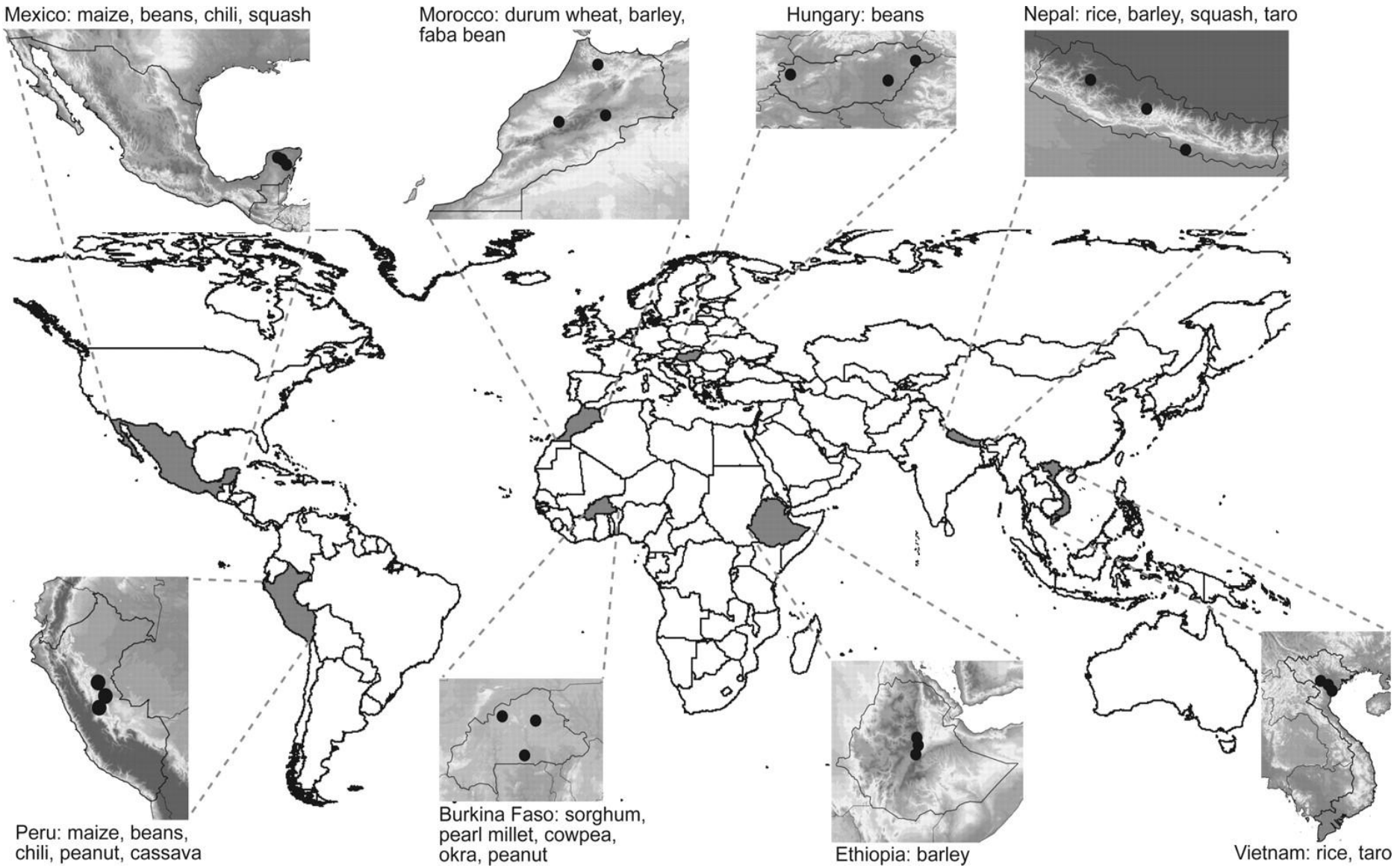
'*Use it or lose it*'

On-Farm Conservation of crop Diversity





Global assessment of traditional crop-variety diversity maintained by farming communities



Jarvis et al. (2008)

Global assessment of traditional crop-variety diversity maintained by farming communities

10 year, coordinated global partnership measured the amount and distribution of genetic diversity present among 27 crop species in farmers fields

- Traditional varieties dominate planting at most sites, except for rice
- On average farmers grow 1.38-4.25 traditional varieties
- There are larger numbers of varieties at the community level – 8x individual level - ranging from 4 (durum wheat) to 60 (cassava), suggesting that different farmers grow different mixes of traditional varieties reflecting different choices of diversity. This underscores the importance of divergence between farms within a community.
- Results underscore the importance of large numbers of small farms adopting distinctive varietal strategies as a major force in retaining crop genetic diversity on farm.
- Well-intentioned interventions that unify landscapes genetically may threaten such diversity in the longterm.

Jarvis et al. (2008)

On-Farm Conservation of crop Diversity

Technology	Farmer-based	Formal Crop breeding
Taxonomy	Folk	Scientific
Circa-situm conservation	Yes	Virtually none
Ex situ conservation	Some community seed banks	Gene banks, long and short-term
Germplasm acquisition	Neighbour exchange / informal	Global / commercial
Interspecific introgression	Limited to natural crosses	Expanded via species techniques
Introgression of weedy races	Common	Sometimes used
Gene technology	No	Yes
Screening germplasm	For local, not wide adaptation	For wide, not local adaptation

Traditional maize seed systems in S-C Mexico & on-farm conservation

80-90% dominance of seed saving

Demand for diversity from farmers; interest in experimentation, but most outside seed sources tested rapidly discarded

Revolving portfolio, resilient system that is highly conservative, but that can innovate as well.

Each farmer is essentially creating and maintaining their own almost unique maize varieties. Maintenance of diversity depends on maintenance of the integrity of the seed system and continued reliance of farmers on saved seed, and this in turn on maintenance of the social and cultural fabric of farming communities.

Willkommen bei ProSpecieRara

ProSpecieRara...

- Rettet und behütet die Vielfalt der Kulturpflanzen und Nutztiere
- Erhält und vermittelt das Wissen und die kulturellen Werte der traditionellen Sorten und Rassen
- Vermittelt den Zugang zu Saatgut und Zuchttieren für jedermann
- Stärkt die gefährdeten Sorten und Rassen über die Förderung der Vermarktung von Spezialitäten
- Leistet mit der Erhaltung der Kulturpflanzen- und Nutztiervielfalt einen wichtigen Beitrag an die Sicherheit unserer Nahrungsmittelversorgung

Mehr über die Ziele von ProSpecieRara.

Newsletter abonnieren

Wenn rare Rohstoffe mit altem Seifenhandwerk veredelt werden...
...entstehen wertvolle Duschseifen. Diese sind aus der Zusammenarbeit von ProSpecieRara mit der Freiämter Seifenmanufakt...
mehr

Buchtipps
Die ProSpecieRara-Experten empfehlen ihre Buchfavoriten zu verschiedenen Themen....
mehr

Rückblick auf den Reutenmarkt
Bratwürste vom Engadinerschaf, Most frisch ab Press und über 40 Birnensorten zum Degustieren - dies die Kurzzusammenfass...
mehr

Gelungene zweite Auflage der Tier-Expo in Brunegg
Am 1. und 2. Oktober 2011 war die Vianco-Arena für einmal mehr das Mekka der Freunde rarer Nutztiere. Mit der Tier-Expo ...
mehr

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pro specie rara

Schweizerische Stiftung für die kulturhistorische und genetische Vielfalt von Pflanzen und Tieren

Willkommen bei ProSpecieRara

Swiss Fruit varieties

At the start of the 20th Centrury there were c.3,000 fruit varieties in Switzerland

Now only around 2,000 remain

>100 growers throighout the country are currently growing c. 1,800 varieties

On-farm conservation here in Switzerland

Am 1. und 2. Oktober 2011 war die Vianco-Arena für einmal mehr das Mekka der Freunde rarer Nutztiere. Mit der Tier-Expo ...
mehr

pro specie rara

Fondation suisse pour la diversité patrimoniale et génétique liée aux végétaux et aux animaux

Aperçu
Bovins
Moutons
Chèvres
Volaille
Lapins
Autres races

Autres thèmes:


Entremise animale: animaux-rares.ch


Qu'est-ce qu'une race ProSpecieRara?


Où puis-je trouver des races de rente ProSpecieRara?


Entretien du paysage et conservation des races de ferme


Garder et élever des

animaux-rares.ch
Le marché des animaux de rente rares

Trouver des animaux rares

Mouton de Saas

Les moutons de Saas sont une type local du mouton Bergamasque. Ces moutons à viande sont grands, sans cornes, aux nez busqués bien marqués et des oreilles tombantes.

Chèvre col gris

Comme son nom l'indique en dialecte haut-valaisan

Chèvre du Simplon

La Capra Sempione (ou chèvre du Simplon) fait

FRUCTUS

Die Vereinigung zur Förderung alter Obstsorten

L'association pour la sauvegarde du patrimoine fruitier

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- IMPRESSUM
- KONTAKT
- RECHTLICHE HINWEISE

WILLKOMMEN BEI FRUCTUS

FRUCTUS will die genetische Vielfalt einheimischer Obstsorten für die nächsten Generationen erhalten und die Öffentlichkeit auf deren Werte aufmerksam machen.

Obstsorten-Erhaltungsprojekte

Was macht Fructus?

- Alte Sorten suchen, erhalten, vermehren und weitergeben
- Sorten beschreiben und erfassen
- Sortenausstellungen organisieren
- Informieren und beraten
- Exkursionen und Kurse durchführen
- 4 x pro Jahr ein Bulletin herausgeben
- Pomologien suchen, erhalten und weitervermitteln
- Ernennung Obstsorte des Jahres
- Führungen auf dem Obstlehrpfad und beim Infopavillon

Für unsere Arbeit sind wir auf Ihre Unterstützung angewiesen. Helfen Sie mit! FRUCTRUS ist offiziell eine gemeinnützige Vereinigung, das heisst Ihre Spenden an uns können Sie von den Steuern abziehen.

Schweizer Obstsorte des Jahres 2010

FRUCTUS hat am 13. 7. 2010 die Kirschensorte "Schöne von Einigen" zur Schweizer Obstsorte des Jahres 2010 erkoren. Nach der Sorte „Schneiderapfel" 2008 und der Birnensorte „Sept-en-gueule" 2009 erfolgte diese Ernennung zum 3. Mal in Folge. Die diesjährige kleine, süsse,

SONNTAG, 31. OKT. 2010
IN HÖRHAUSEN/TG
TAG DER NUSS

BIODIVERSITÄT 2010

www.fructus.ch

Accueil
Association
Objectifs
Historique
Documents
Devenir membre
Pomologie
Fondation
Vie du verger
Inventaire & Variétés
Vergers conservatoires
Votre arbre sur mesure
Arboriculture
SOS Vergers
Cours de taille & de greffe
Manifestations & Activités
Ethnobotanique
Jus, vin-cuit & raisinée
Recettes
Liens
Accès réservé

Association

Présentation de l'association

Dans les années 1980, la Suisse avait déjà perdu plus des deux tiers de son verger traditionnel

- L'écran de verdure des villages disparaît, le paysage rural traditionnel s'uniformise
- La faune spécifique liée à ces milieux est en péril
- La diversité fruitière s'appauvrit. Des coutumes, des recettes, des saveurs quittent ainsi notre mémoire...

Interpellés par ce constat, quelques Neuchâtelois fondent en 1987 l'association appelée aujourd'hui :

Rétropomme
Association pour la sauvegarde du patrimoine fruitier de Suisse romande

Les buts de l'association sont :

- Le maintien du verger traditionnel en faveur du paysage et d'une faune et flore spécifiques
- La conservation des anciennes variétés locales et le patrimoine socioculturel qui leur est lié

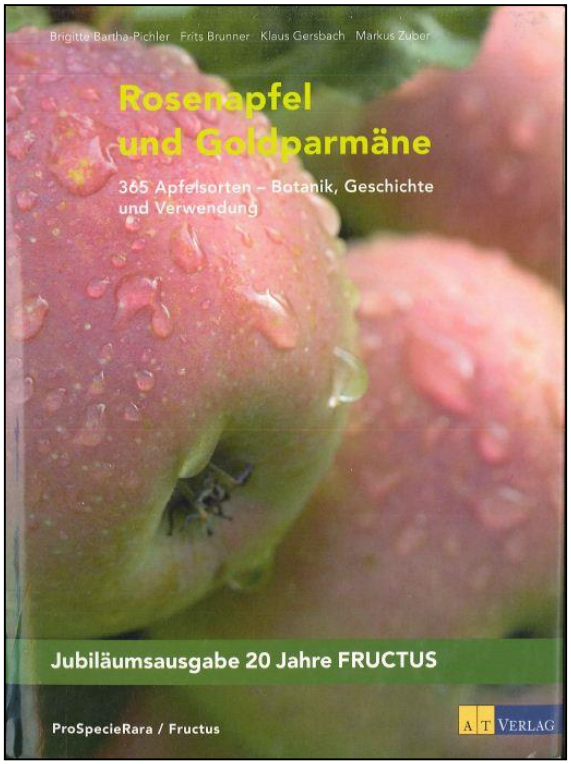
Le contexte socio-économique moderne focalisé sur le rendement met en évidence le rôle fondamental que peut jouer une association comme Rétropomme, défendant la diversité biologique. Ce rôle, elle entend l'assumer avec l'aide de tous ceux et celles qui pensent avoir la responsabilité de préserver et de remettre en valeur l'héritage du passé pour les générations à venir.

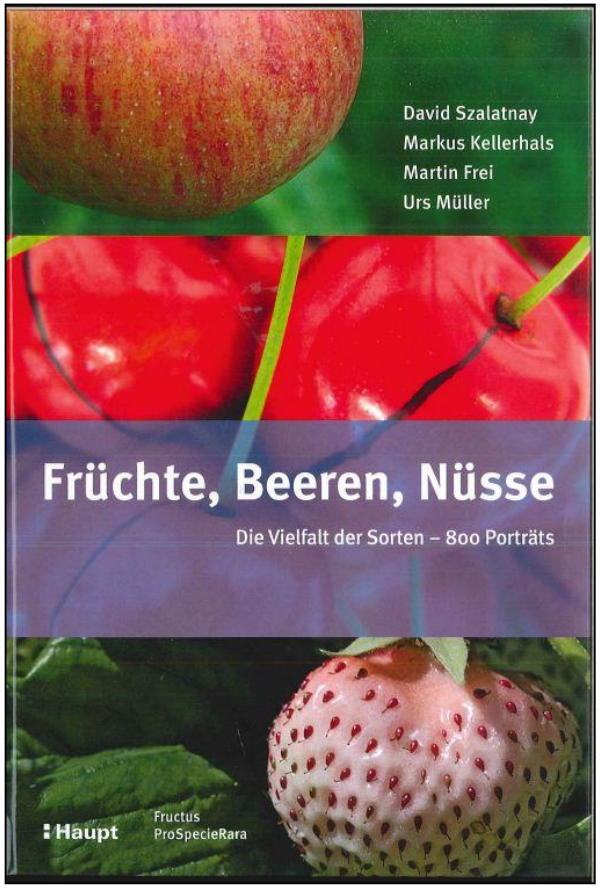
Sur le plan national, Rétropomme participe activement à la réflexion sur la gestion moderne des ressources génétiques dans le cadre du Plan d'Action National pour la conservation des ressources phytogénétiques pour l'agriculture et l'alimentation (PAN).

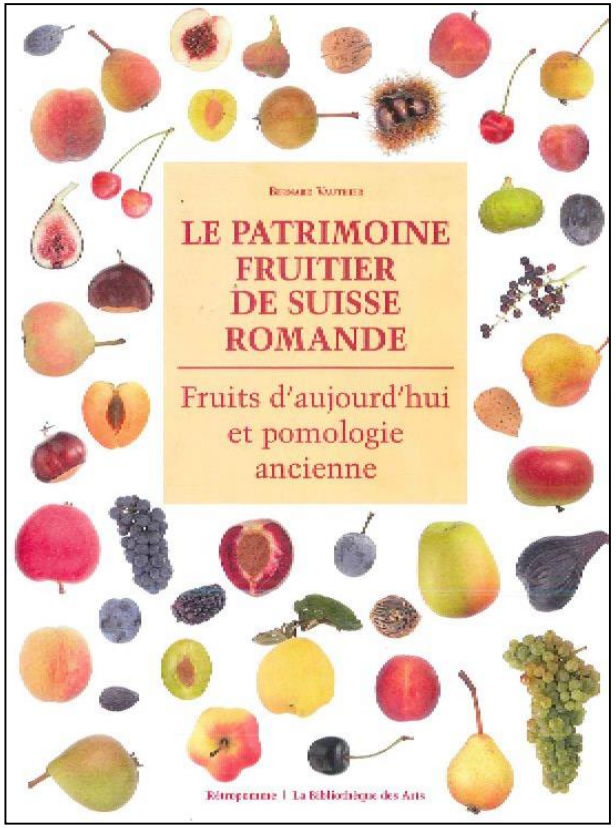
Fructus – the Swiss Association for the Protection of Fruit Diversity: http://www.fructus.ch/

ProSpecieRara - http://www.prospecierara.ch/Generator.aspx?tabindex=0&tabid=128&palias=fr

Retropomme – Association et fondation pour la sauveguarde de le patrimoine frutier du Suisse Romande - http://www.retropomme.ch







Fruit petit (3,3 g), réniforme, présentant un sillon du côté dorsal mais non du côté ventral qui est convexe. • Pédoncule souvent court (31-48 mm), hâlé de rouge-brun à l'insolation, se détachant franchement. • Point pistillaire situé dans une dépression inclinée du côté ventral. • Peau grenat virant au noir. La suture ventrale est difficilement perceptible. • Chair ferme et même croquante, modérément sucrée, douce avec une touche d'amertume. Le jus est grenat. • Noyau petit (8,2-9,7 mm), allongé, très peu modelé. • Maturité tardive et échelonnée (de la mi-juillet à la mi-août). • Echantillon prélevé chez André Besson à Véron (Lugnn).

Cerise **GADEAU**

Cette Guinde ⊛ est une grosse cerise de table sensible à la pluie. On la trouve à Treytorrens, naguère à Champtauroz et Cronay. On dit Gadó ou Kadó vers 1880 à Cossonay, Pailly et Penthalaz[a]. Elle ressemble à la Cassadent II ⊛.

Fruit de bonne grosseur (7 g), cordiforme, allongé. Le sillon ventral est très estompé. • Pédoncule vert, tacheté de rouge à l'insolation, ne faisant pas saigner le fruit. • Point pistillaire inséré sur un méplat incliné. • Peau rouge-grenat, parsemée de lenticelles plus claires, virant au noir à maturité complète. La suture ventrale est à peine perceptible. • Chair grenat, ferme, sucrée, à saveur relevée et jus foncé. • Noyau relativement petit, allongé (10,5-12,8 mm), guère épaulé à la naissance des arêtes ventrales, un peu conique vers l'avant, arrondi au sommet, bien modelé (les rides ventrales sont parfois carénées). • Maturité dans la première moitié de juillet. • Echantillon prélevé chez Thierry Correvon à Treytorrens (Payerne).

Cerise **GAFION**

Ce Greffion ⊛ provient de Troistorrents.

Fruit petit (3,1 g), cordiforme, épaulé latéralement et passablement symétrique dorso-ventralement. • Pédoncule vert pâle rougi à l'insolation (28-56 mm). Il ne fait guère saigner le fruit mais le cléforme à l'arrachage. • Point pistillaire apical, enfoncé ou affleurant. • Peau mince uniformément. • Chair rouge nordtte assez ferme, sucrée, à saveur relevée. Le jus est très foncé. • Noyau ovale-allongé (9-11,2 mm), incliné du côté ventral à la base, arrondi au sommet. Les rides sont presque invisibles du côté dorsal. • Maturité moyenne (première moitié de juillet). • Echantillon prélevé chez Lucien et Henri Premand à Chenarlier (Troistorrents).

Cerise **GRAFION BRUN**

Ce Greffion ⊛ de belle venue provient de Puidoux. Dans la Broye, il était confit dans du kirsch.

Fruit de bonne grosseur (6,7 g; Ø 20-25 mm), cordiforme ou allongé, aplati du côté ventral, pointu vers l'avant. • Péconcule vert pâle (47-65 mm), déformant le fruit à l'arrachage. • Point pistillaire apical, modérément enfoncé. • Peau sombre, grenat homogène plus ou moins intense, opaque. • Chair rouge blanchâtre en périphérie, foncée près du noyau, mi-ferme, à saveur relevée, agréablement sucrée. Le jus est rouge. • Noyau allongé (10,9-14 mm), ovoïde, proéminent à la naissance des arêtes ventrales, terminé en angle obtus. Les rides latérales sont fines et rarement carénées; les rides dorsales sont presque invisibles. • Maturité dès la mi-juillet. • Echantillon prélevé chez Francis Chevalley à Longchamp (Puidoux).

Cerise **GRAFION NOIR**

Ce Greffion ⊛ parfaitement cordiforme provient de la Broye fribourgeoise. Il est vraisemblab-ement d'introduction récente.

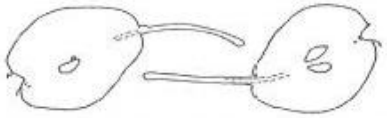
sous forme de pendeaux[192]. Dans le domaine toponymique, on note à Bercher *Poirier es Femmes* en 1771 et *Poirier aux Femmes* actuellement[193].

Poirier Coéa en 2023 à Montalchez

Poire **COUÈLA**

Cette variété de Miex et naguère de Vionnaz est nommée Coëla ou Kola en 1901 à Roche VD et Vouvry[194]. On trouve *Coulin* vers 1690 à Monireux[195].

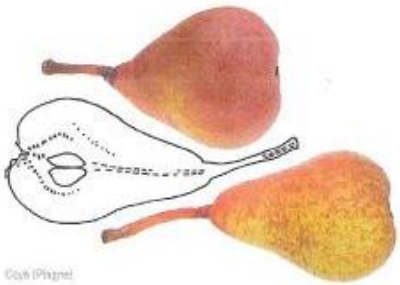
Fruit petit (Ø 29-41 mm), ovoïde ou piriforme, franc à la base. • Pédoncule (23-46 mm) légèrement arqué garni de bourgeons vestigiaux. • Œil saillant à sépales dressés. • Peau verte, nuancée de jaune, passant au rouge-brun à l'insolation, lisse. La tache colorée est rarement intense. • Chair ferme, mi-fine, très juteuse, moyennement sucrée, à saveur peu prononcée. • Pépins souvent racornis. L'axe est plein. • Maturité et chute des fruits au tout début d'octobre. • Echantillon prélevé à Miex sous la conduite de Gérard Pierchamp, de Vouvry.



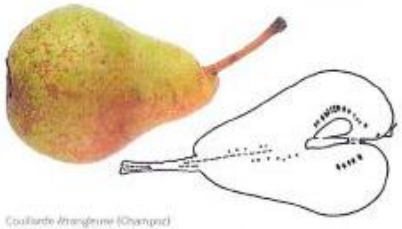
Poire **COUILLARDE ÉTRANGLEUSE** ou **COYÉ**

Ce type de fruit du luza bernois se prête au séchage. A Plagne, il est rissolé dans de la graisse puis mijoté avec de l'eau, du sucre, de la farine, des pommes de terre, du lard et un peu de sel. On dit Couillarde ou Couillarde étrangleuse à Champoz et Coyé à Plagne. L'appellation dérive de Collia ⊛.

Fruit moyen ou sous-moyen (Ø 50-53 mm, 75 g), fuselé, ventru, décurrent à la base avec quelques bourrelets, plis ou parfois un tuberculé. • Pédoncule souvent charnu (13-43 mm), revêtu de fauve (sauf parfois à l'ombre à l'implantation et en deçà des bourgeons vestigiaux). Le revêtement déborde plus ou moins sur le fruit. • Œil irrégulièrement ouvert à sépales effilés et parfois rougis, implanté dans une dépression ténue ou plus marquée, réticulée ou, le plus souvent, franchement voilée de fauve. • Peau jaune pâle, voilée, maculée ou réticulée de fauve, en général lisse et luisante, hâlée de rouge fragmenté à l'insolation, rarement avec des ébauches de stries. • Chair mi-ferme, mi-fine, pierreuse, juteuse avant maturité complète, un peu astringente (Champoz), sucrée et non dépourvue d'arôme (Plagne). • Pépins en partie racornis. L'axe est creux. • Maturité et chute des fruits dans la première moitié de septembre. • Echantillon prélevé chez Jean-Robert Dumoulin à Plagne et chez Jean Girod et Jean von Bergen à Champoz.



Coyé (Plagne)



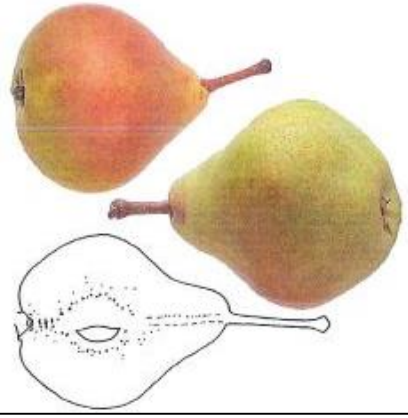
Couillarde étrangleuse (Champoz)

Appellation **COURBE** → [Courbe, Courbet]

Ce nom se rapporte à la forme de l'arbre plutôt qu'à celle du fruit. Il apparaît dans le domaine toponymique. En 1346 et 1717 près d'Arcuse et de Mézières, des limites passent respectivement par *le Perie Corbe* et le *pied d'un Poirier Corboz*[196]. En 1572, un *Poirier Corbet* figure au cadastre des Clées[197].

Poire **COURBE**

Ce fruit de Surpierre (poire Corbe), Trey et Villars-le-Comte est encavé ou pressuré pour le vin-cuit*. Il mûrit en 1901 à Chavannes-sur-Moudon, Forel-sur-Lucens et dans Lavaux[198].



Rigler

330

Herkunft
Kanton Appenzell (Schweiz)

Verbreitung
Ostschweiz

Erntezeit und Lagerung
Anfang Okt.; Feb.

Baum
Wächst mittelstark, bringt mittlere Erträge. Wenig schorfanfällig. Blüht mittelspät.

Frucht
Klein bis mittelgroß, 50–65 mm hoch, 60–75 mm breit, kugelig bis rechteckig oder stumpf kegelförmig, oft unregelmäßig gebaut. Kanten breit und unregelmäßig stark ausgeprägt. Kelchhöcker schwach bis mittelstark. Kelchgrube mitteltief, schmal, etwas gerippt. Kelch klein, geschlossen bis halb offen. Stielgrube tief, mittelbreit, schwach bis mittelstark berostet. Stiel 15–25 mm lang, mitteldick bis dick. Grundfarbe grüngelb, Deckfarbe rot bis dunkelrot verwaschen, marmoriert und gestreift, bis ¾. Lentizellen wenig zahlreich, groß, hell umhöft. Kelchhöhle dreieckig, Staubblätter mittig. Kernhaus klein bis mittelgroß, zwiebelförmig, teils auch kugelförmig, Achse spaltig zu den Kernfächern hin offen. Kerne braun, länglich, teilweise entwickelt. Fruchtfleisch grünlich, mitteifest, grobzellig, saftig, mäßig gehaltvoll in Zucker und Säure, fein aromatisch.

Roggenapfel

331

Herkunft
Eriswil, Kanton Bern (Schweiz)

Erntezeit und Lagerung
Ende Juli; Mitte Aug., nur kurz lagerbar

Baum
Bäume werden ziemlich groß. Blüht relativ früh.

Frucht
Mittelgroß, 55–65 mm hoch, 60–70 mm breit, breit kugel-kegelförmig bis stumpf kegelförmig, deutliche Kanten und stark ausgeprägte Kelchhöcker. Kelchgrube mitteltief und schmal. Kelch mittelgroß, geschlossen, mit ziemlich langen und aufgerichteten Kelchblättern. Stielgrube mitteltief und mittelbreit. Stiel kurz und dick. Grundfarbe grüngelb. Deckfarbe fehlend oder orangerot verwaschen bis marmoriert und fein geflammt, bis ½. Lentizellen grün umhöft. Kelchhöhle breit dreieckig, Staubblätter mittig. Kernhaus mittelgroß, zwiebelförmig, halb offen bis offen. Kerne mittelgroß, länglich oval, voll entwickelt. Fruchtfleisch grünlich weiß, fest, etwas zellulosig, knackig, mittelsaftig, süß, fein aromatisch.

Wissenswertes
Diese Lokalsorte kommt aus der Gemeinde Eriswil im Oberaargau, Kanton Bern (Schweiz). Den Namen Roggenapfel erhielt die Sorte auf Grund der gleichzeitig mit der Roggenernte zusammenfallenden Reife.

Juli-Dechantsbirne

492

Synonyme
Jullibirne, St. Michel d'été, Doyenné de Juillet, Doyenné d'été, Jolimont précoce, Roi Jolimont

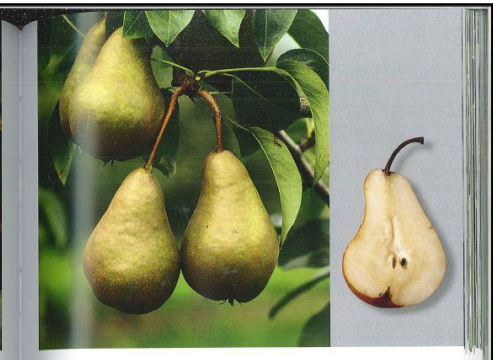
Herkunft
Frankreich

Erntezeit und Lagerung
Mitte–Ende Juli; 8–10 Tage haltbar

Baum
Wuchs sehr schwach, Baum sehr klein, säulenförmig, gedeiht auch in Höhenlagen. Auf Quittenunterlage unverträglich. Erträge gut und regelmäßig. Wenig schorfanfällig. Blüht früh, diploid, Pollen gut.

Frucht
Klein, 35–40 mm hoch, 30–40 mm breit, ei- bis kreiselförmig. Stiel mittellang, mitteldick bis dick, fleischig in die Frucht übergehend. Kelch offen. Kelchgrube fehlend oder flach. Kelchröhre kurz trichterförmig. Kernhaus klein, kugelförmig, kelchwärts, Achse geschlossen. Mittelgroße, bauchige, hellbraune Samen mit Dorn, manchmal weiß. Haut glatt, trocken, einzelne Rostflecke, sonst ohne Berostung. Grüne bis gelbe Grundfarbe. Deckfarbe ¼ bis ½, leuchtend rot verwaschen. Fleisch gelblich, halb schmelzend, saftig, mäßig gewürzt, rasch mehlig. Interessant wegen der frühen Reife, sofort zu konsumieren.

Wissenswertes
Von der Baumschule Baltet in Troyes (Frankreich) aus Samen gezogen, 19. Jahrhundert. Oft Hochstamm- und Espalierbäume.



Kaiser Alexander

493

Synonyme
Boscs Flaschenbirne, Beurré Bosc, Kaiserbirne, Beurré d'Apremont

Herkunft
Frankreich

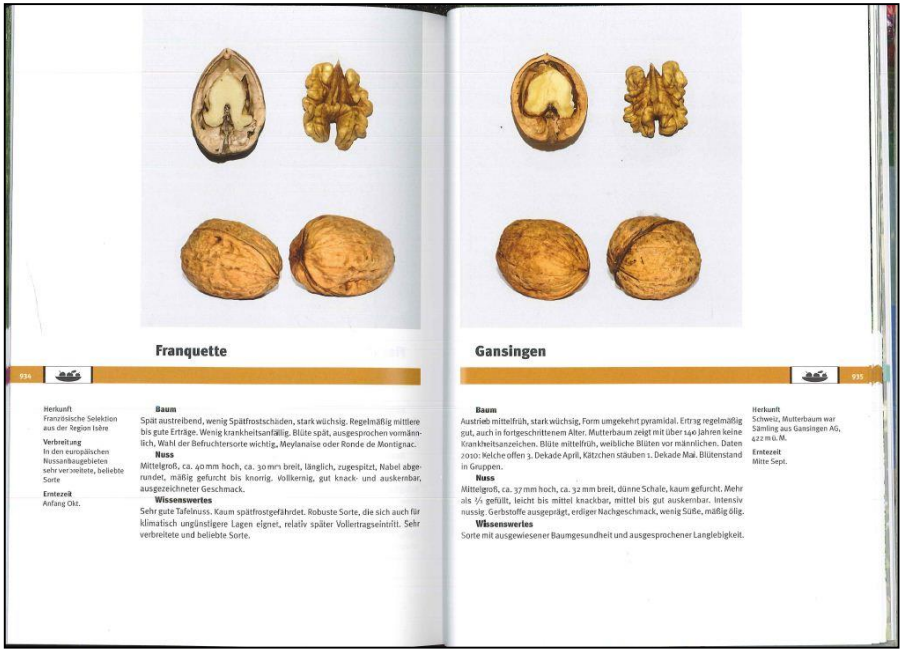
Verbreitung
Wichtige Handelssorte

Erntezeit und Lagerung
Mitte Sept.; März

Baum
Als Hoch- und Niederstamm geeignet. Wächst mittelstark, etwas auskahlend. Ertragseintritt mittelspät, bringt gute Erträge, neigt etwas zu Alternanz. Mit Quittenunterlagen nicht verträglich. Mäßig blattschorfanfällig, häufig Fruchtschorfbefall, feuerbrandanfällig. Blüht mittelspät bis spät, diploid, Pollen gut.

Frucht
Mittelgroß bis groß, 90–120 mm hoch, 55–80 mm breit, flaschenförmig, kelchbauchig, stielwärts lang gespitzt und eingezogen. Stiel lang, dünn, holzig, 2,5–4 cm, meist gebogen. Stiel aufsitzend und fleischig in die Frucht übergehend. Stielgrube fehlend. Kelch offen oder halb offen. Kelchröhre kurz trichterförmig. Kernhaus groß, spindelförmig, Achse lochartig geöffnet. Kerne voll entwickelt, aber klein, dunkelbraun, bauchig. Haut rau, trocken, typisch ganzflächig kupferbraun berostet. Grundfarbe grüngelb. Lentizellen unauffällig. Fleisch gelblich, halb schmelzend, feinkörnig, saftig, süß mit angenehm würzigem Aroma.

Wissenswertes
Zufällig entstanden, etwa im Waldviertel Argument. Heute Säfte, Frankreich, gefunden



Franquette

934

Herkunft
Französische Selektion aus der Region Isère

Verbreitung
In den europäischen Nussanbaugebieten sehr verbreitete, beliebte Sorte

Erntezeit
Anfang Okt.

Baum
Spät austreibend, wenig Spätfrostschäden, stark wüchsig. Regelmäßig mittlere bis gute Erträge. Wenig krankheitsanfällig. Blüte spät, ausgesprochen vormännlich, Wahl der Befruchtersorte wichtig, Meylanaise oder Ronde de Montignac.

Nuss
Mittelgroß, ca. 40 mm hoch, ca. 30 mm breit, länglich, zugespitzt, Nabel abgerundet, mäßig gefurcht bis knorrig. Vollkernig, gut knack- und auskernbar, ausgezeichneter Geschmack.

Wissenswertes
Sehr gute Tafelnuss. Kaum spätfrostgefährdet. Robuste Sorte, die sich auch für klimatisch ungünstigere Lagen eignet, relativ später Vollertragseintritt. Sehr verbreitete und beliebte Sorte.

Gansingen

935

Herkunft
Schweiz, Mutterbaum war Sämling aus Gansingen AG, 422 m ü. M.

Erntezeit
Mitte Sept.

Baum
Austrieb mittelfrüh, stark wüchsig, Form umgekehrt pyramidal. Ertrag regelmäßig gut, auch in fortgeschrittenem Alter. Mutterbaum zeigt mit über 140 Jahren keine Krankheitsanzeichen. Blüte mittelfrüh, weibliche Blüten vor männlichen. Daten 2010: Kelche offen 3. Dekade April, Kätzchen stäuben 1. Dekade Mai. Blütenstand in Gruppen.

Nuss
Mittelgroß, ca. 37 mm hoch, ca. 32 mm breit, dünne Schale, kaum gefurcht. Mehr als ½ gefüllt, leicht bis mittel knackbar, mittel bis gut auskernbar. Intensiv nussig. Geschmack ausgeprägt, erdiger Nachgeschmack, wenig Süße, mäßig ölig.

Wissenswertes
Sorte mit ausgewiesener Baumgesundheit und ausgesprochener Langlebigkeit.

Johannisbeeren

Gloire des Sablons

848

Herkunft
Frankreich, 1854. Sämling von Rose de Champagne

Verbreitung
Gelegentlich in alten Haus- und Liebhabergärten

Erntezeit
Mittel

Pflanze
Mittelstarker, aufrechter bis halbaufrechter Wuchs. Austrieb mittelfrüh. Junge Blätter und Triebe nur mit schwacher Anthocyanfärbung, ältere Blätter hell- bis mittelgrün, unterseits mittelstark flaumig behaart, mit offener Blattbas s. Mäßig anfällig für Blattfallkrankheit. Blüten mittelgroß bis groß, tellerförmig, gelbgrün, in der Abblüte deutlich rot, lang gestielt, in lockerem, bogig abstehendem Blütenstand, Blütenstandachse grün.

Beere
Mittelgroß, zum Traubenende hin kontinuierlich kleiner, kugelig bis abgeflacht kugelig, am Traubenende zum Teil auch angedeutet feigenförmig, 10 s 3, mittelfest, in mittellangen bis langen, locker besetzten Trauben. Fein parfümierter, auffallend süßer Geschmack.

Wissenswertes
Mäßiger Ertrag. Verlangt ausreichend feuchte und nährstoffreiche Böden in milder Klimalage. Ähnlich der Sorte Rose de Champagne (vgl. S. 861), aber die

Johannisbeeren

Heros

849

Herkunft
Deutschland, 1912, seit 1927 im Handel. Abstammung unbekannt, gefunden in einer Kultur von Laxton's Perfection, in den Handel gebracht von H. Rosenthal in Rötha bei Leipzig

Verbreitung
Vereinzelt in alten Hausgärten

Erntezeit
Mitteifrüh

Pflanze
Schwacher, eher lockerer, halbaufrechter Wuchs, mäßige Regenerationsfähigkeit. Winterknospen klein, kaum bereift. Austrieb und Blüte früh. Junge Blätter hell- bis mittelgrün, mit schwacher bis mäßiger Anthocyanfärbung, ausgewachsene Blätter groß, auffallend stumpflappig, mit grob gekerbtem, etwas nach unten gebogenem Blattrand. Blattbasis offen bis fast gerade, Hauptadern im Sommer oft rötlich. Mittelstark anfällig für Blattfallkrankheit. Blüten groß, tellerförmig, in der Abblüte nicht rötlich, gelbgrün, in bogig hängenden Blütenständen, Blütenstandachse grün.

Beere
Groß, kugelig bis abgeflacht kugelig, mittelrot, eher weich, in meist langen, nur mäßig dicht besetzten Trauben. Ziemlich aromatisch, süß-säuerlicher Geschmack.

Wissenswertes
Mittlerer Ertrag, gute Pflückbarkeit. Nicht transportfest. Beeren am Strauch nicht


Dole
BANANAS
afrifresh
citrus
quality
Ananas
Reinke

http://lostcrops.org/

BIO235 Course Assessment

Course Assignment = 50%

Exam = 50%

Exam will be on Tuesday 18th Dec 10:15-11:45 = 1.5 hrs

Mix of short answer questions and short essay questions covering the whole course

All of them will be easy & straightforward!

BIO 235 Plants and People - Evolution and Domestication of Crops

Student Course Evaluation (LVB) - (Nr. 15573)

- Link to survey: https://qmsl.uzh.ch/en/AMNWA

- Survey period: Nov 19 – Dec 9, 2018 (Reminder: Dec 3)

- Number of participants, who receive the access data automatically: 26 participants