



In the Shadow of the Volcano and Along the River

The Cultural Ecology of Yogyakarta

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Introduction

- In the millennia since their arrival, humans have been intrinsically linked to the Javanese landscape.
- Just as they shape the environment, it has shaped and defined their lives.



An island dotted in volcanoes. Map data: Esri.

Introduction

- One way in which we can understand this relationship is the role, growth, and environmental impact of agriculture.



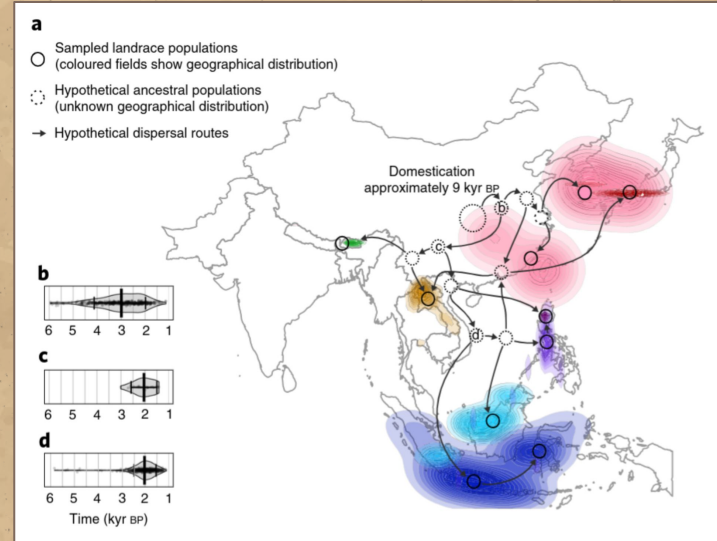


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A brief history of rice in Indonesia

Origins of rice in Indonesia

- Rice is not indigenous to Indonesia.
- Originating in the Chinese and Indian highlands, it arrived in western Indonesia as long as 4,000 years ago.
- In eastern Indonesia, it was virtually absent until recently.



Gutaker et al. (2020)

Rice in early Mataram

- By the construction of Borobudur in the 8th century, the burgeoning central Javanese kingdom of Mataram was underpinned by its relationship with rice farmers.
- Rice was both a market commodity and the basis of the state's agricultural tax systems.
- At this time, relatively low populations meant that an extensive irrigation system was unnecessary.

Rice in mid-era Mataram

- By the 10th century, Mataram's expansion necessitated a similar expansion in its agricultural output.
 - Allowing for more predictable harvests and thus taxes.
 - Keeping people in place and "domesticating" the countryside.
- Rulers encouraged farming communities to shift towards irrigated rice.

Rice in mid-era Mataram

- Though it offered tax incentives, the state could not coerce its population towards a more labor-intensive agricultural method.
- Instead, natural drivers were the likely reasons they switched:
 - Increased fertility provided by irrigation, and greater crop volume and predictability.
 - Population increase and changes in land ownership.

Rice in mid-era Mataram

- Lacking coercion, the state left the practical organization of irrigation to communities.
- Instead, large water works were dressed in mysticism:
 - Supported through religious benefice, they were religious, not functional acts.
- Mythologies relating to water—many of which are still in place today—were borne out of this need for rulers to frame water beyond physical terms.

Dutch colonialism

- The colonialism period, driven by profit-generation, was marked by a shift towards export crops, such as sugar and coffee.
- Unconverted paddy fields focused on increasing yield, through breeding and more extensive irrigation.
- Unlike earlier Javanese states, labor was coerced and systematized.

Rice in the New Order

- The dominance of rice in modern Indonesia stems from the state's rice-centered food policy, starting with Sukarno and expanded by Suharto.
- By 1990, production focused high-yielding varieties.
 - Diversity of rice reduced from over 8,000 to only six varieties.
- In eastern Indonesia, traditional staples such as sago were quickly replaced by rice.

A photograph of a person wearing a straw hat and a light-colored shirt, standing in a vast field of tall, golden-brown rice. The person is holding a sickle, ready to harvest. The field is filled with rice stalks, and the background is a soft, hazy landscape.

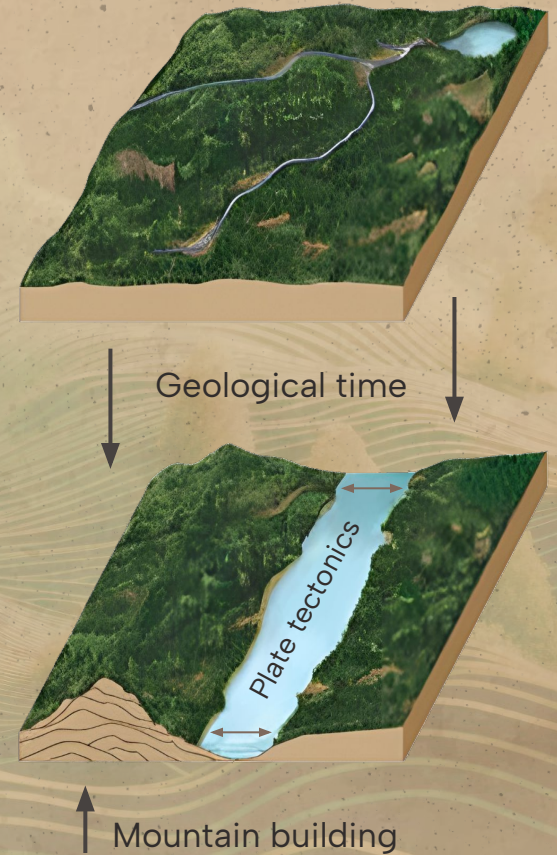
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Why Merapi?

The geographic template

- Non-random patterns of spatial variation.
 - Forms foundation for all biogeographic patterns.
- Biogeographic patterns derive from regular spatial variation in the environment:
 - Spatial variation is highly predictable.
 - Influences biological communities (directly & indirectly).
 - Species diversity, species composition, vital processes (productivity).

- 5 Influence of "ecosystem engineers" on the geographic template (e.g., formation of beaver ponds, forest fragmentation, pollution).
- 4 Interactions among species.
- 3 Temporal dynamics of the template (plate tectonics, sea level changes, oceanographic processes, climate change, mountain building).
- 2 Responses of biotas (adaptation, dispersal, evolution, or extinction).
- 1 The geographic template.

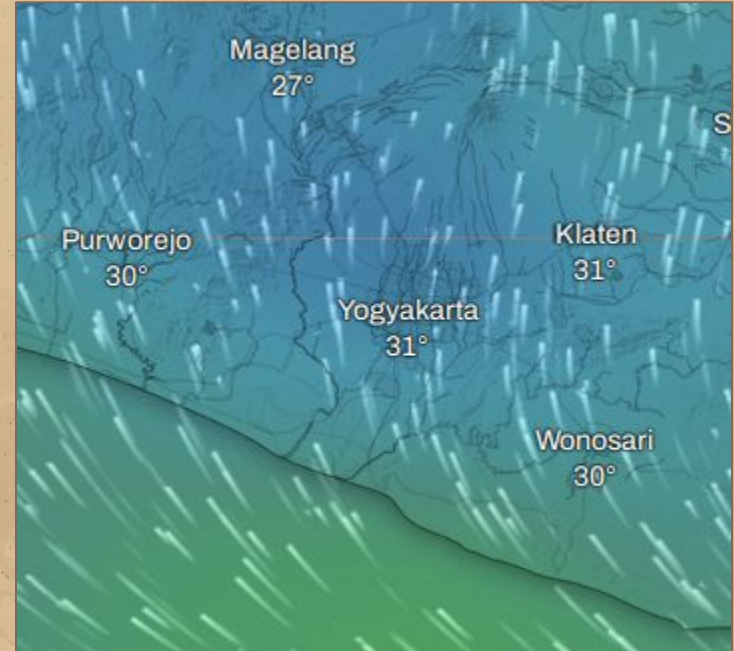


Climate and topography

- Rice cultivation—and farming generally—is uniquely suited to the climate of the southern plains of Mt. Merapi:
 - Relatively stable climate, moderate seasonal shifts.
- And its topography:
 - Shallow inclines, many small and medium-sized rivers that lead to the south.

Water capture

- Merapi also receives southern winds.
- This allows it to capture moisture, watering its southern slope.
- Even in the dry season, water continuously and predictably flows to the south.



Observe the upward flow of moisture-bearing wind.
Map data: Windy.

Mineral-rich ejecta

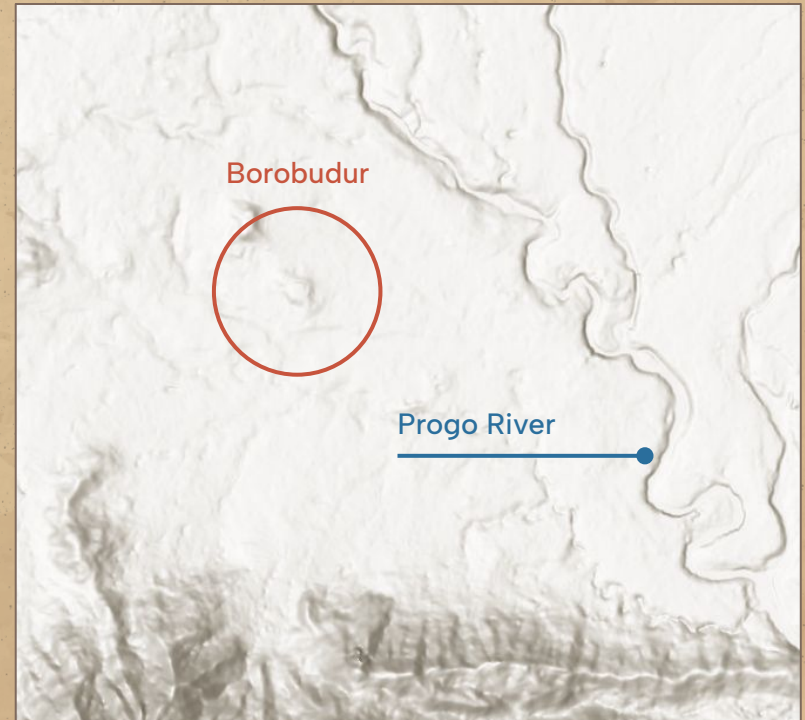
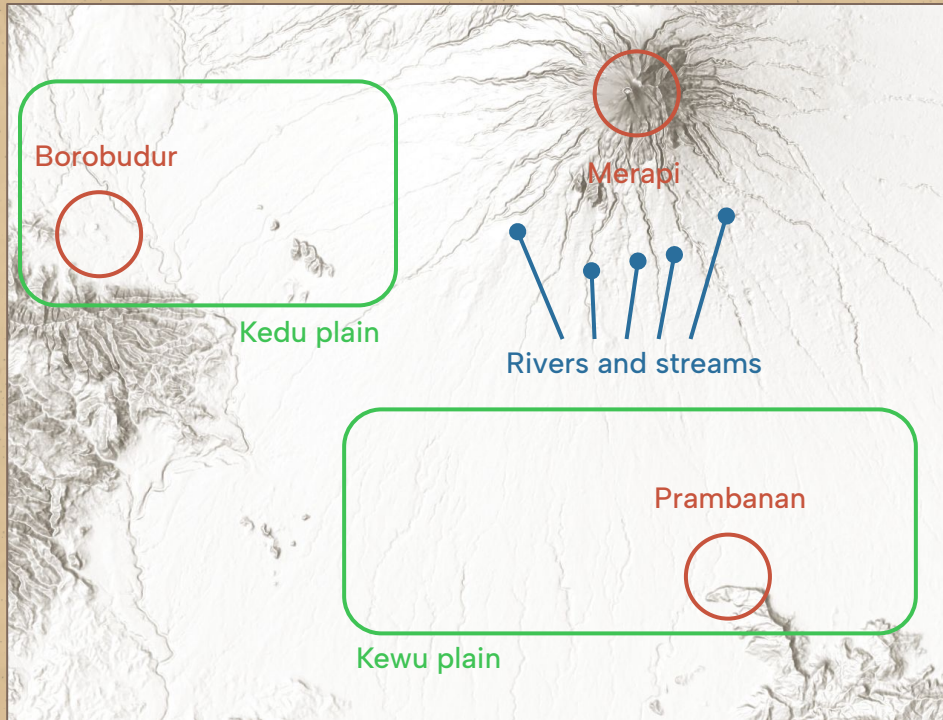
- Meanwhile, ejecta are released on a continual basis, usually non-violently.
- This mineral-rich output fertilizes Merapi's slopes and the lowland, and is carried as silt in rivers and streams.



A potentially perfect balance

- Throughout history, humans have been cognizant of the destructive power of volcanoes, as well as the life that emanates from them.
- However, Merapi's year-round water, rich soil, and a easy terrain enabled its inhabitants to build an agrarian empire.
- But there is always a price—Mataram lasted for three centuries before a catastrophic eruption forced it east.

The locations of important cultural works were consequently chosen strategically: in fertile plains, near freshwater, where agriculture was most productive.



Hillshade maps of the southern Merapi landscape. Map data: Esri.

A deal made with the volcano

- These factors explain humans' reluctance to abandon Merapi even when the state does.
- Belief systems are developed, giving mystical rather than physical reasons for its eruptions.
 - It brings positive change.
 - Loss is spiritual not physical.



a massive
eruption
every
now and then



the best
crops
in the land



Humans and their environment

Humans and their environment

- Humans are deeply reliant on ecosystems:
 - Food, water, wood, biochemicals, etc.
 - Regulation of the climate, diseases, and water.
 - Shaping of culture, aesthetics, sense of place.
- We thus ascribe certain values to nature.
- These values govern our interactions with nature, determine our willingness to exploit or protect it.

The values we ascribe to nature



Economic

- Monetary value of resources.
- Cash crops.
- Drugs and chemicals.
- Genes for agriculture.



Utilitarian

- Direct use.
- Goods: wood, food, water.
- Services: prevent erosion, purify water, cycle and nutrients, regulate climate.



Psychological

- We derive pleasure from nature, directly or indirectly.
- Beauty, forest bathing.



Intrinsic

- Acknowledging the inherent value of life in and of itself, regardless of our interactions with it.

These values determine our priorities



Save the orangutan...

or...



eat gorengan?

Values associated with rice cultivation

Period		Value
Early Javanese	→	Subsistence
Peak Mataram	→	Trading influence
Dutch Colonialism	→	Profit
Independent Indonesia	→	Self-sufficiency

Environmental impact of these values

Period		Value		Impact
Early Javanese	→	Subsistence	→	Land conversion
Peak Mataram	→	Trading influence	→	Waterway modification
Dutch Colonialism	→	Profit	→	Landscape modification, genetic changes from breeding
Independent Indonesia	→	Self-sufficiency	→	Chemical overuse, low diversity, lower land productivity

Consequences of our values

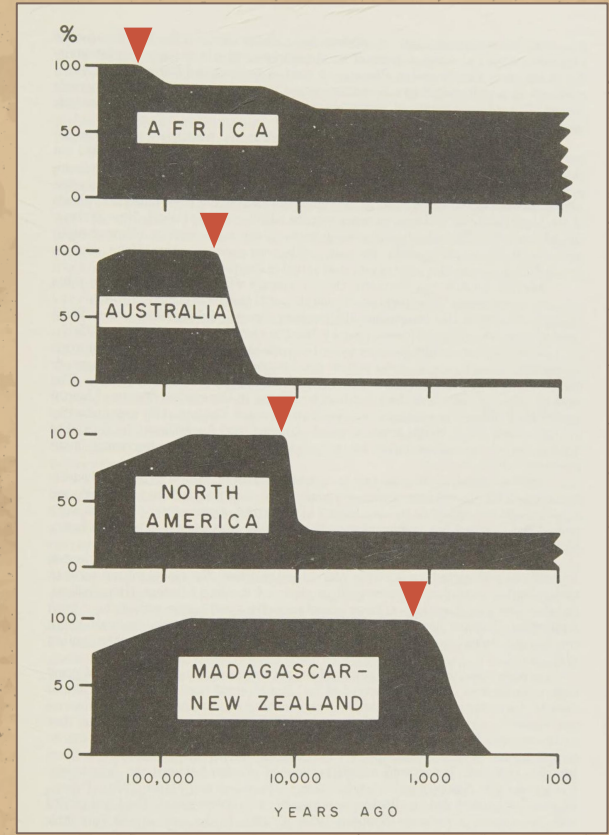
- Some values incontrovertibly have worse outcomes.
 - The profit motive inherently requires sacrificing other values—including protecting nature.
 - An individual's values aren't on the same scale as the state's values.
- Nevertheless, values have consequences, both positive and negative.
- Humans have always impacted their environment.

Humans always have an impact

- The harmful ways in which we have impacted the world around us:
 - Habitat destruction.
 - Invasive species.
 - Pollution.
 - Population pressure.
 - Overharvesting.

This is not a modern phenomenon

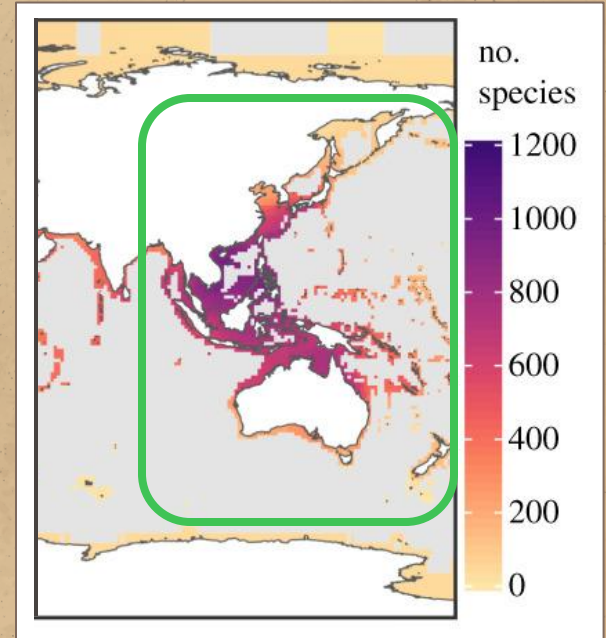
- This impact has always been historically true.
- Even among our ancestors, extinction of native species has followed us everywhere we go.



Martin and Klein (1984)

Our impact is magnified in Indonesia

- Biodiversity hotspots account for a significant portion of life.
- On just 1.4% of land:
 - 44% of all plants.
 - 35% of all vertebrates.
- Damaging these areas is thus disproportionately harmful.



Schumm et al. (2019)



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Recontextualizing rice production

Recontextualizing rice production

- With an understanding of our propensity to impact the environment, even from seemingly minor interactions, is our understanding of rice production any different?
- In spite of its proclivity for Merapi's landscape, is cultivating rice actually good?

Rice... and us

- Rice is not a very nutritious or healthy staple.
 - Overconsumption of it—at the cost of more nutritious food—has resulted in stunting in children.
- Monoculture reduces the diversity of diets.
- Converting diets away from native staples has modified dietary traditions.
- Because it's more intensive, wet rice farming has altered the work–life balance of farmers.

Rice... and our environment


- Because rice is not indigenous, that means it replaced native crops already adapted to this environment.
 - These crops, like sago and cassava, are less vulnerable to climate fluctuations.
- Monoculture crops have a negative impact on biodiversity and make for poor ecosystems.
- They can also result in lower pest resistance and higher susceptibility to disease.

Rice... and the climate


- The method that increases rice production might be the same one that ends up killing us:
 - Irrigated rice promotes higher methane emissions.
- As the global population increases, so must food production, necessitating both more sustainable agricultural methods and changing dietary habits.
 - A return to dry rice?

End

Thanks for watching, reading, and/or listening.

 <https://allisfoundintime.com>

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