



SUSTAINABILITY AND ECO-SOCIAL CHANGES

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Lesson 3 - Sustainability

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DECISIONAL CASE:
The Almond Valley

Let's radically change our perspective:
what does a bee think about this situation?



A decorative background consisting of a repeating pattern of red and black abstract shapes, resembling stylized leaves or branches, positioned at the top and right edges of the slide.

Why Change Perspective?

The Almond Valley debate is framed entirely around human concerns: economics, identity, technology, politics.

But the central actors of this crisis — the bees — have no voice in the discussion that determines their fate.

This is not a naive exercise in anthropomorphism. It is an analytical tool: by imagining what the crisis looks like from below, we reveal dimensions that human-centred frameworks systematically hide.

What changes in our analysis when we decenter the human perspective?



THE BEE'S WORLD **A Different Sensory Ecology**

WHAT HUMANS PERCEIVE

A landscape of orchards and fields

Almond trees as economic assets

Seasons as calendar dates

Weather as daily convenience

The valley as property and territory

WHAT BEES PERCEIVE

A mosaic of scent trails and UV patterns

Flowers as complex chemical signals

Seasons as shifts in light and temperature

Weather as existential pressure on the colony

The valley as a web of foraging routes

Bees navigate through dance, pheromones, electromagnetic fields, and ultraviolet light. Their 'world' is radically different from ours – but no less real.



CRISIS FROM BELOW **What Has Changed — The Bee's Experience**

● Before 2015

Stable foraging routes. Predictable seasonal rhythms. The hive as a self-regulating superorganism.

● 2015-2018

First disruptions. Some foragers don't return. Colony stress increases. Varroa mites proliferate as winters shorten.

● 2019-2022

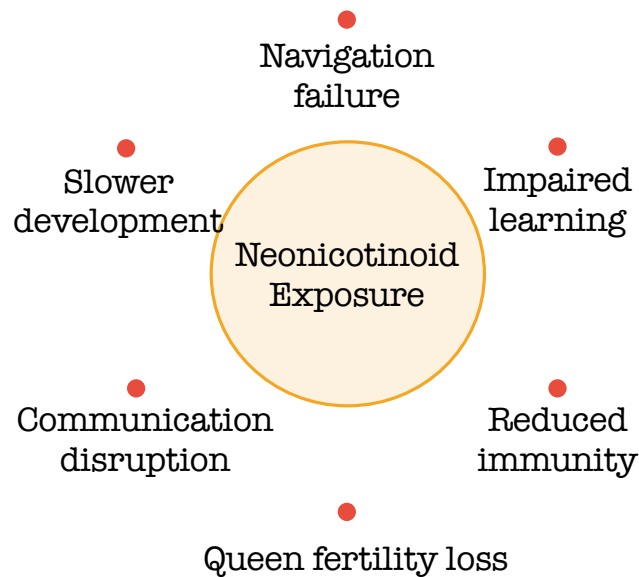
Collapse accelerates. 40%→55%→70% winter losses. Tasks shared by thousands fall on hundreds.

● 2023-2024

Critical threshold. ~50 hives from 180. Failed pollination. Each spring begins with fewer bees than ever.

THE CHEMICAL THREAT

How Neonicotinoids Affect Bees



Lab results show pesticide traces "below lethal levels" — but lethality is the wrong threshold.

Sub-lethal effects destroy colonies slowly, invisibly, cumulatively. A bee that cannot navigate home is as lost as a dead bee.



COMPOUNDING CRISIS **Climate Change × Varroa Destructor**

Warmer winters

Eliminate cold period that suppressed Varroa mites. The mites now reproduce year-round.

Earlier spring warming

Disrupts synchrony between bee emergence and flower blooming. Bees wake up, but flowers may not be ready.

Extreme weather

Droughts, late frosts stress colonies already weakened by pesticides and parasites.

From the bee's perspective, the crisis has no single cause. It is a convergence — 'multiple stressor syndrome.' Each pressure alone might be survivable. Together, they are catastrophic.

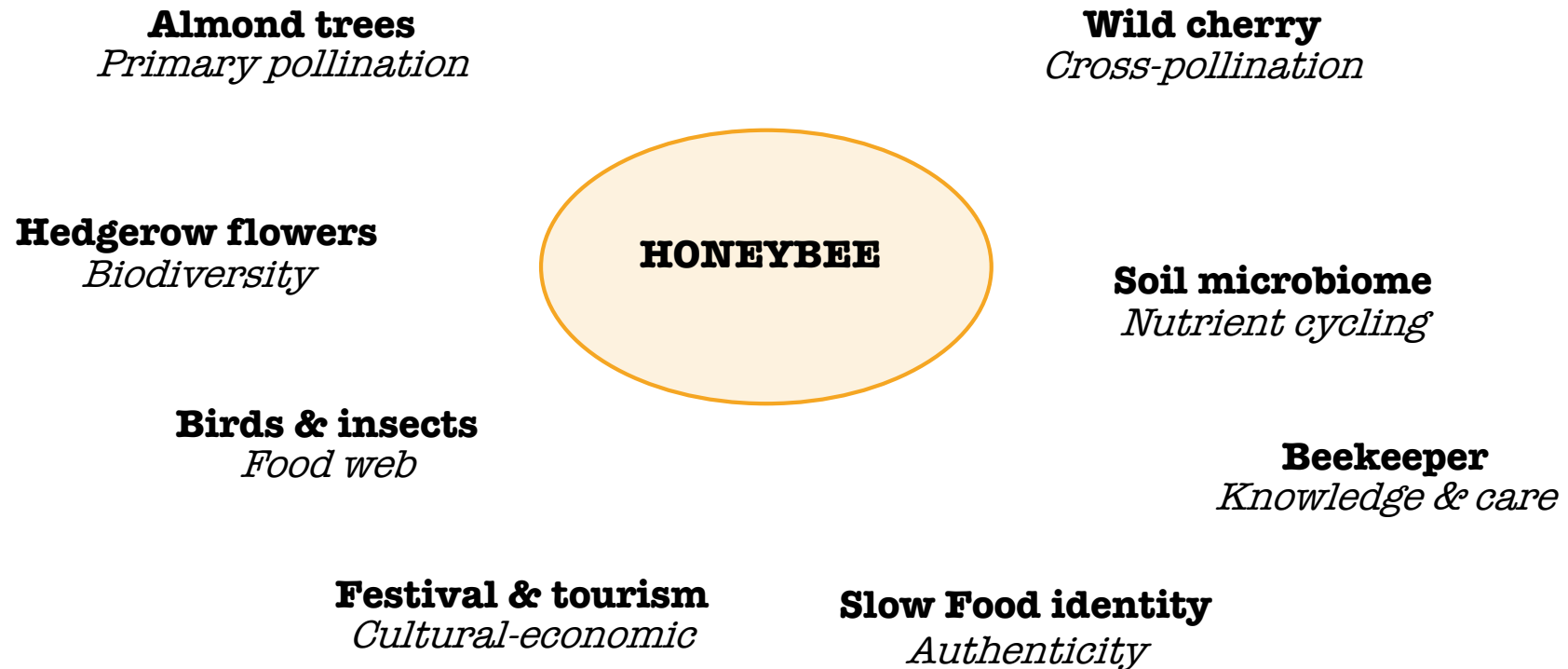
Bee Pollination vs. Drone Pollination

What the PolliBot replaces – and what it cannot

DIMENSION	BEE	DRONE
Flowers visited	All flowering species in range	Target crop only (almonds)
Pollination quality	Variable, adapted to each flower	Standardised, mechanical
Wild flora	Cross-pollinated as by-product	Completely ignored
Ecosystem role	Food source for birds, spiders, etc.	None
Honey & wax	Produced as colony metabolism	None
Cost structure	Free (if bees survive)	Dependent on private company
Adaptability	Evolves with environment	Requires updates & maintenance
Autonomy	Self-organising, self-replicating	Controlled by AgriDrone / investors

ECOLOGY OF
CONNECTIONS

Bees Are Not a Function. They Are a Relationship





TWO WORLDVIEWS **What the Drone 'Sees' vs. What the Bee Knows**

THE DRONE'S 'WORLD'

GPS coordinates of almond orchards
Flower density maps
Optimal flight paths (efficiency)
Target: pollen transfer per minute
Success = almond yield


THE BEE'S WORLD

Scent gradients across the valley
Memory of yesterday's best flowers
Communication with 10,000 sisters
Target: colony survival
Success = the whole ecosystem thriving

The drone optimises a single variable. The bee sustains a system.

BEYOND
POLLINATION

What Bees Provide That Drones Cannot

	Crop Pollination	The only function drones replicate	✓ Drone covers
	Wild Flora Pollination	Maintaining biodiversity	✗ Drone ignores
	Food Web Participation	Feeding birds, spiders, insects	✗ Drone ignores
	Genetic Diversity	Cross-pollination creates resilient plants	✗ Drone ignores
	Honey & Wax Production	Economic and cultural products	✗ Drone ignores
	Environmental Monitoring	Bee health = ecosystem health indicator	✗ Drone ignores
	Cultural & Relational Value	Traditions, identity, sense of place	✗ Drone ignores

Drones replicate ~20% of what bees provide. The remaining 80% — ecological, cultural, relational — is simply lost.

VALUE
ANALYSIS

Four Types of Value – Applied to Bees

INSTRUMENTAL VALUE

Are bees useful?

Yes – pollination, honey, wax. But this is the ONLY value drones can partially replicate.

RELATIONAL VALUE

What relationships do bees create?

Bee ↔ flower, bee ↔ beekeeper, bee ↔ ecosystem, bee ↔ identity. Remove the bee and the web unravels.

INTRINSIC VALUE

Do bees matter in themselves?

Father Luigi says yes (creation).
Silvano's 50-year relationship says yes.
But intrinsic value carries little weight in economic debate.

CULTURAL VALUE

What do bees mean?

The Festival, the Slow Food Presidium, Silvano's family tradition, the 'hum' of the valley. Meaning no machine can generate.

The AgriDrone proposal addresses only instrumental value. The other three are treated as irrelevant externalities.



ANALYTICAL
REFLECTION

What Changes When We Take This Perspective?

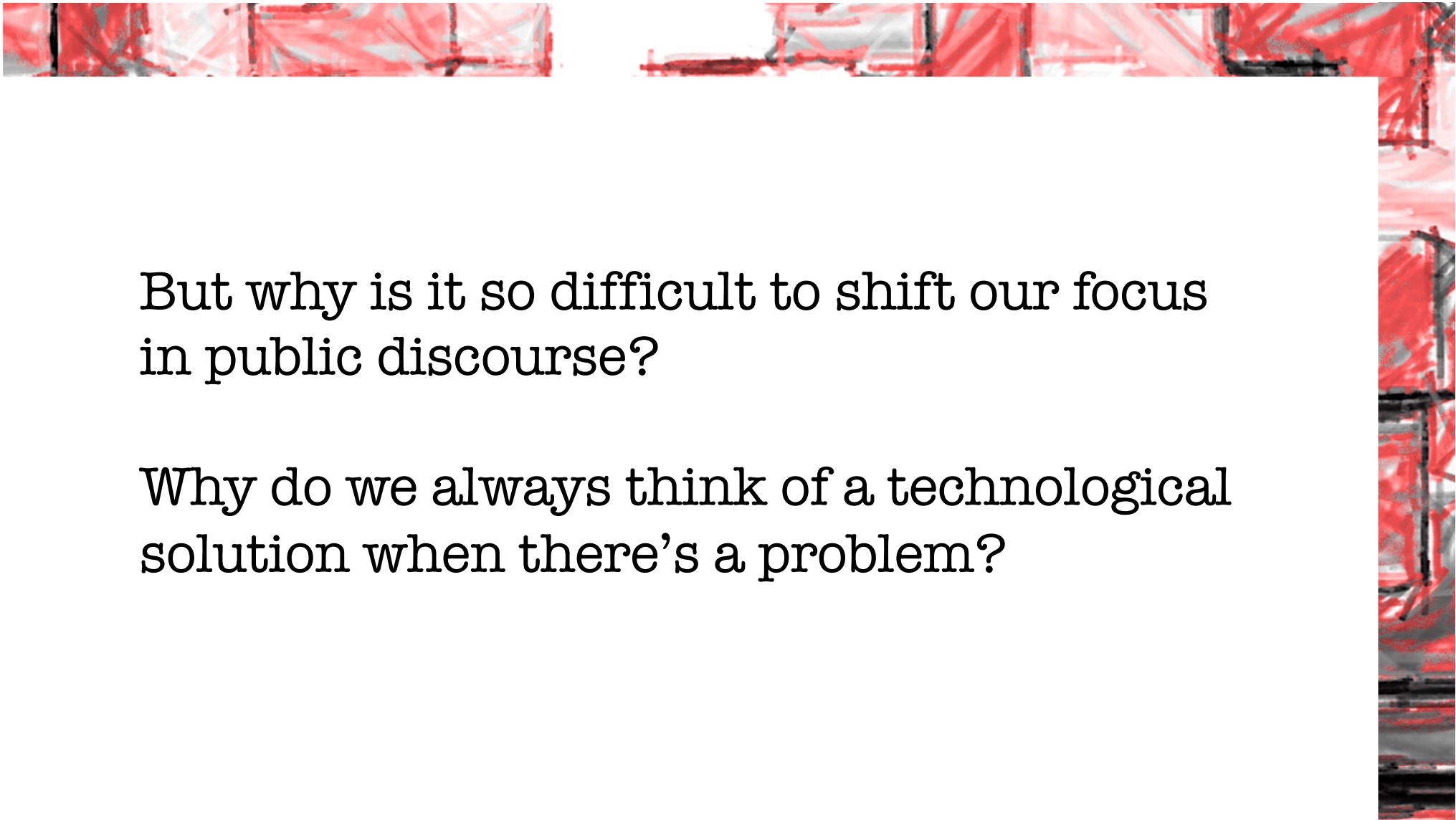
The debate shifts from 'how to replace pollination' to 'how to save an ecological relationship.' The question is no longer technical but relational.

The 'invisible actors' become visible. Bees, wild pollinators, the broader ecosystem move from background to foreground.

The injustice becomes starker. The most affected actors (bees) have zero agency. Those who cause the problem are entirely absent.

The value framework tips. Instrumental value alone cannot justify replacing a living system with a machine.

Perspective-shifting is not sentimentality. It is an analytical method that reveals what human-centred frameworks systematically obscure.

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But why is it so difficult to shift our focus
in public discourse?

Why do we always think of a technological
solution when there's a problem?



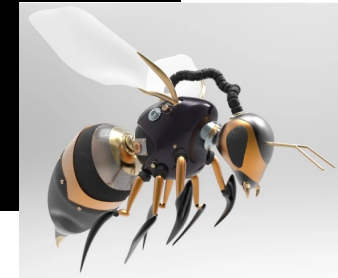
RESEARCH & INNOVATION TRANSFER

Walmart begins farming with robot bees

The US retail giant has filed six patents for drones that will pollinate flowers, among other things. But research on autonomous flying microrobots has been in full swing for years now.

18 May 2018 Barbara Rusch

ARCHIVE Archived content: Links may have been removed or no longer work.





Robotic bees for crop pollination: Why drones cannot replace biodiversity

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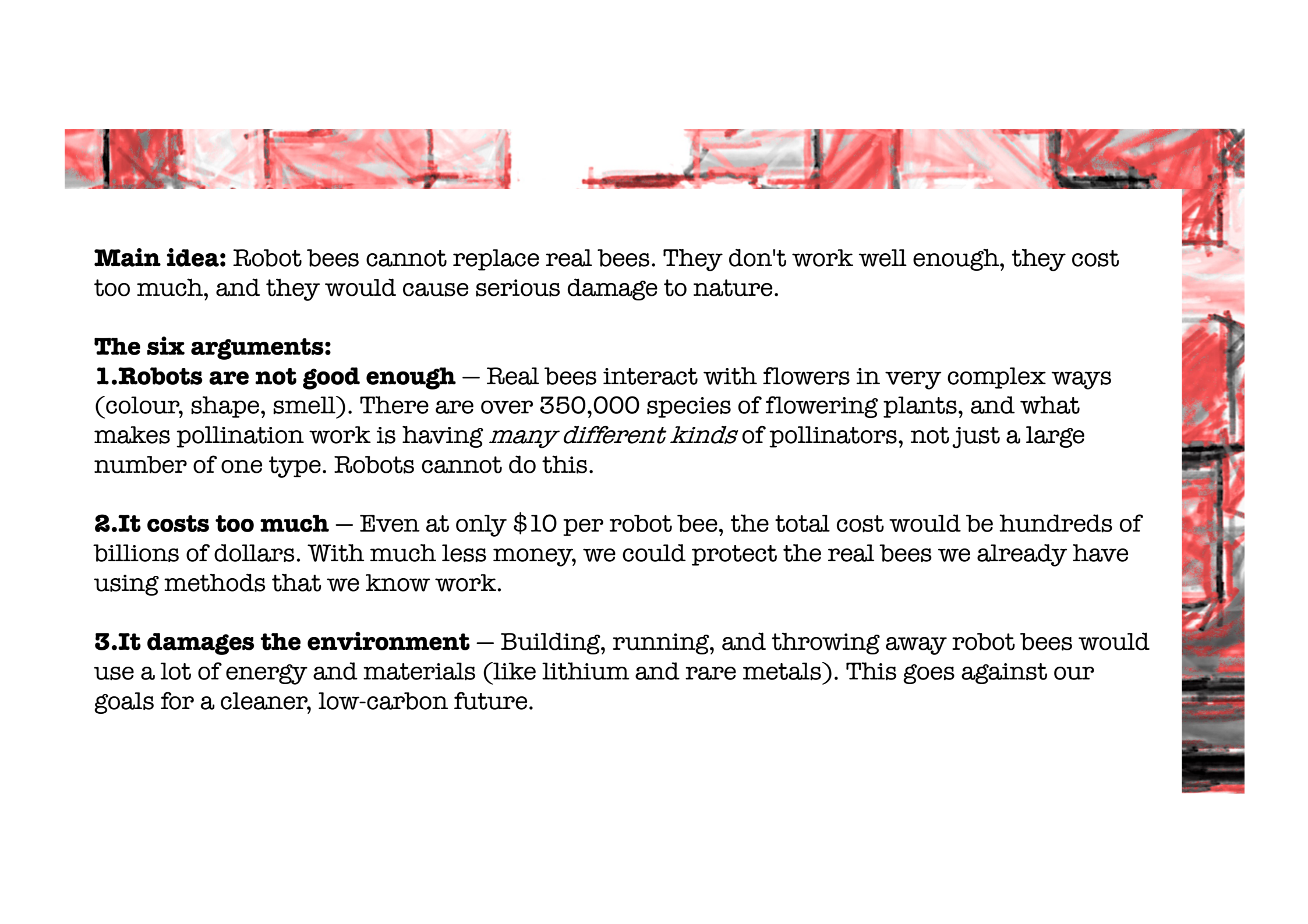
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A B S T R A C T

The notion that robotic crop pollination will solve the decline in pollinators has gained wide popularity recently ([Fig. 1](#)), and in March 2018 Walmart filed a patent for autonomous robot bees. However, we present six arguments showing that this is a technically and economically inviable 'solution' at present and poses substantial ecological and moral risks: (1) despite recent advances, robotic pollination is far from being able to replace bees to pollinate crops efficiently; (2) using robots is very unlikely to be economically viable; (3) there would be unacceptably high environmental costs; (4) wider ecosystems would be damaged; (5) it would erode the values of biodiversity; and, (6) relying on robotic pollination could actually lead to major food insecurity.




Main idea: Robot bees cannot replace real bees. They don't work well enough, they cost too much, and they would cause serious damage to nature.

The six arguments:

1. Robots are not good enough — Real bees interact with flowers in very complex ways (colour, shape, smell). There are over 350,000 species of flowering plants, and what makes pollination work is having *many different kinds* of pollinators, not just a large number of one type. Robots cannot do this.

2. It costs too much — Even at only \$10 per robot bee, the total cost would be hundreds of billions of dollars. With much less money, we could protect the real bees we already have using methods that we know work.

3. It damages the environment — Building, running, and throwing away robot bees would use a lot of energy and materials (like lithium and rare metals). This goes against our goals for a cleaner, low-carbon future.




4. It harms ecosystems – Millions of robot bees in nature would act like an invasive species. They would push out real pollinators and fail to pollinate wild plants that need animal pollination.

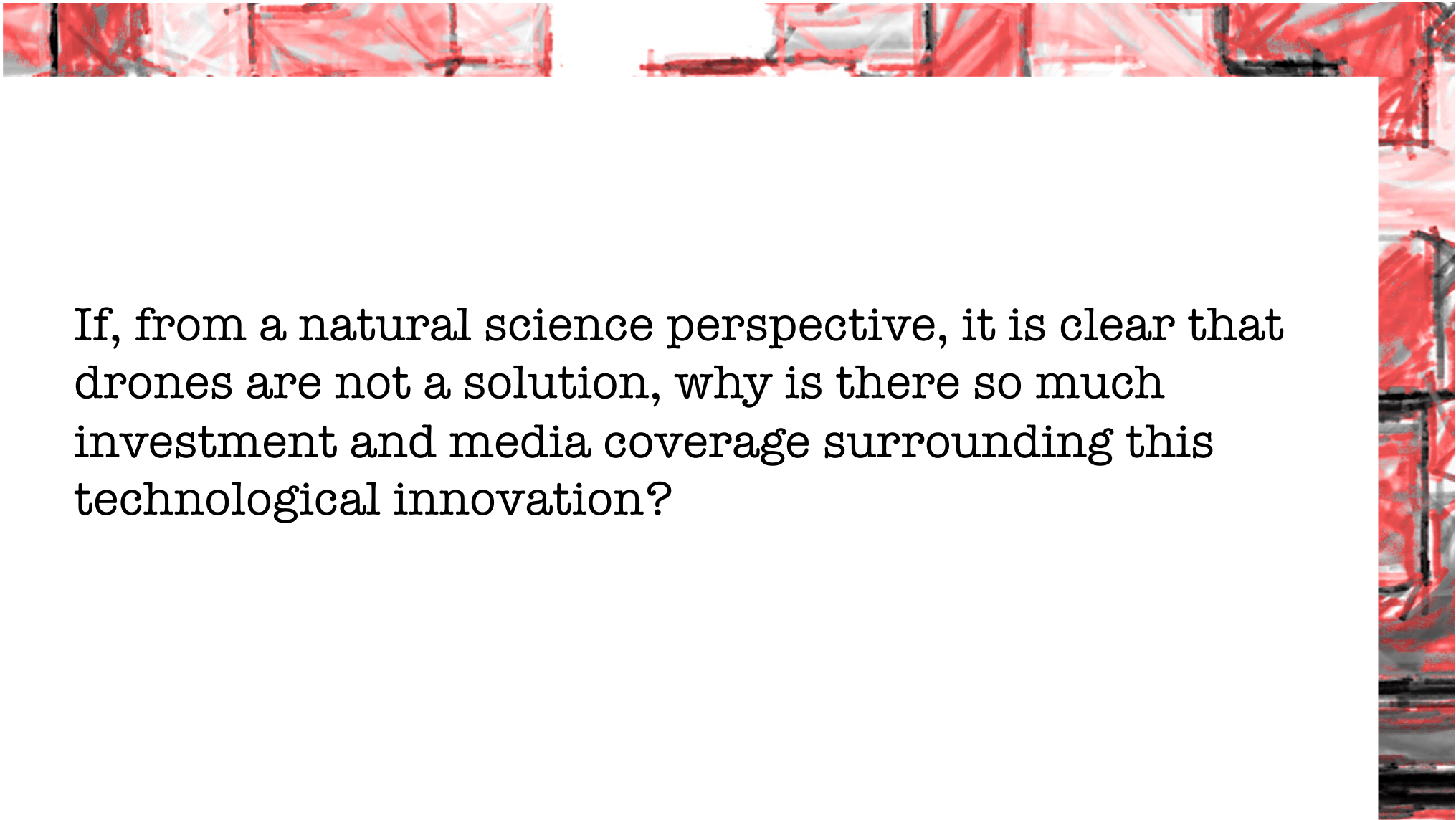
5. It ignores the value of biodiversity – Pollinators have value beyond their "job." They are important for culture (like beekeeping), beauty, and they inspire people to care about nature.

6. It makes food less safe, not more – Depending on one technology is risky (it can break, or be hacked). Also, more than 2 billion small farmers in poor countries could never pay for robot pollination.

What should we do instead? Protect pollinator habitats, make farms more friendly to biodiversity, and develop crops that need less pollination. These solutions already exist, they just need more money and political support.

A useful way to think about it: The authors say robot bees are "a technological solution looking for a problem», while the real solutions are already available but ignored.



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If, from a natural science perspective, it is clear that drones are not a solution, why is there so much investment and media coverage surrounding this technological innovation?

Not All Knowledge Is Equal

In modern societies, some types of knowledge are considered more "serious", more "objective", and more useful than others. This creates a hierarchy.

ENGINEERING, COMPUTER SCIENCE, DATA SCIENCE

Quantifiable, scalable, patentable

**MORE
POWER**

BIOLOGY, ECOLOGY, EARTH SCIENCES

Complex systems, uncertainty, long time scales

SOCIOLOGY, ANTHROPOLOGY, POLITICAL ECOLOGY

Values, justice, power, culture, lived experience

**LESS
POWER**

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Why Does Technological Knowledge Dominate?

It promises profit

Technology creates products, patents, and markets. Investors and companies prefer solutions they can sell.

It promises speed

"We can build a solution" sounds faster and more reassuring than "We need to change how society works."

It sounds precise

Numbers, data, algorithms seem more "objective" than talking about ecosystems, values, or culture.

It attracts funding

Tech research gets more money from governments and companies. Ecology and social science get much less.



What Ecological Knowledge Offers (but struggles to sell)

Ecological knowledge says:

- Systems are complex and interconnected
- Biodiversity is not replaceable
- Quick fixes often create new problems
- Long-term observation matters more than short-term innovation
- Uncertainty is honest, not a weakness

But it struggles because:

- It cannot easily be turned into a product
- It speaks of limits, not growth
- It requires long time horizons
- It challenges powerful economic interests

- It does not offer simple, marketable answers



Technological Solutionism

Evgeny Morozov (2013)

The belief that every complex social problem has a clean technological solution – and that this solution is always better than changing social, political, or economic systems.

1. It redefines problems to fit available technologies
(pollination becomes a "data and robotics" problem)
2. It ignores root causes (why are bees declining?)
(pesticides, monocultures, habitat loss = political problems)
3. It concentrates power in the hands of tech companies
(Walmart filed the robot bee patent, not farmers)

Knowledge vs. Power

	ENGINEERS / TECH	BIOLOGISTS / ECOLOGISTS
How they see the problem	A technical gap that can be filled with innovation	A systemic crisis caused by agriculture and economic choices
What they propose	Build robotic pollinators to replace bees	Protect habitats, reduce pesticides, support biodiversity
Who funds them	Large corporations (Walmart), venture capital, tech industry	Public research, NGOs, international bodies (IPBES)
Media attention	High – "robot bees" is an exciting headline	Low – "protect habitats" is not news
Sustainability model	Very Weak: nature can be replaced by technology	Strong / Very Strong: nature cannot be substituted



What Is a Knowledge Regime?

A knowledge regime is a historically specific system in which certain forms of knowledge dominate, certain institutions produce and validate that knowledge, and certain social groups benefit from it.

**What counts
as knowledge?**

What types of
knowledge are
considered valid,
serious, true?

**Who produces
it?**

Which
institutions,
disciplines,
professions have
authority?

**Who benefits
from it?**

Which social
groups gain power,
money, or
influence?



MEDIEVAL - 16TH C

1. Theological Regime

Valid knowledge: Sacred texts, divine revelation, Church authority

Producers: Clergy, monasteries, universities under Church control

Beneficiaries: The Church, feudal elites, landowners

Nature understood as: God's creation, sacred order. Studying nature = reading God's book.

Biology's status:

Almost non-existent as a separate discipline. Nature studied only as part of theology.



17TH - 18TH CENTURY

2. Enlightenment Regime

Valid knowledge: Empirical observation, reason, classification, experiment

Producers: Scientific academies, natural philosophers, explorers

Beneficiaries: Emerging bourgeoisie, colonial empires, trading companies

Key idea: Bacon: “knowledge is power.” Nature becomes an object to classify and master.

This is when the separation of nature and culture begins.

Biology's status:
HIGH

Natural history is the most prestigious science. Linnaeus, Buffon, Humboldt. Classifying nature = the highest intellectual activity. Botanists and explorers are heroes.



19TH - EARLY 20TH C.

3. Industrial / Positivist Regime

Valid knowledge: Measurable, productive, applicable.
Comte's positivism: only what you can measure is real.

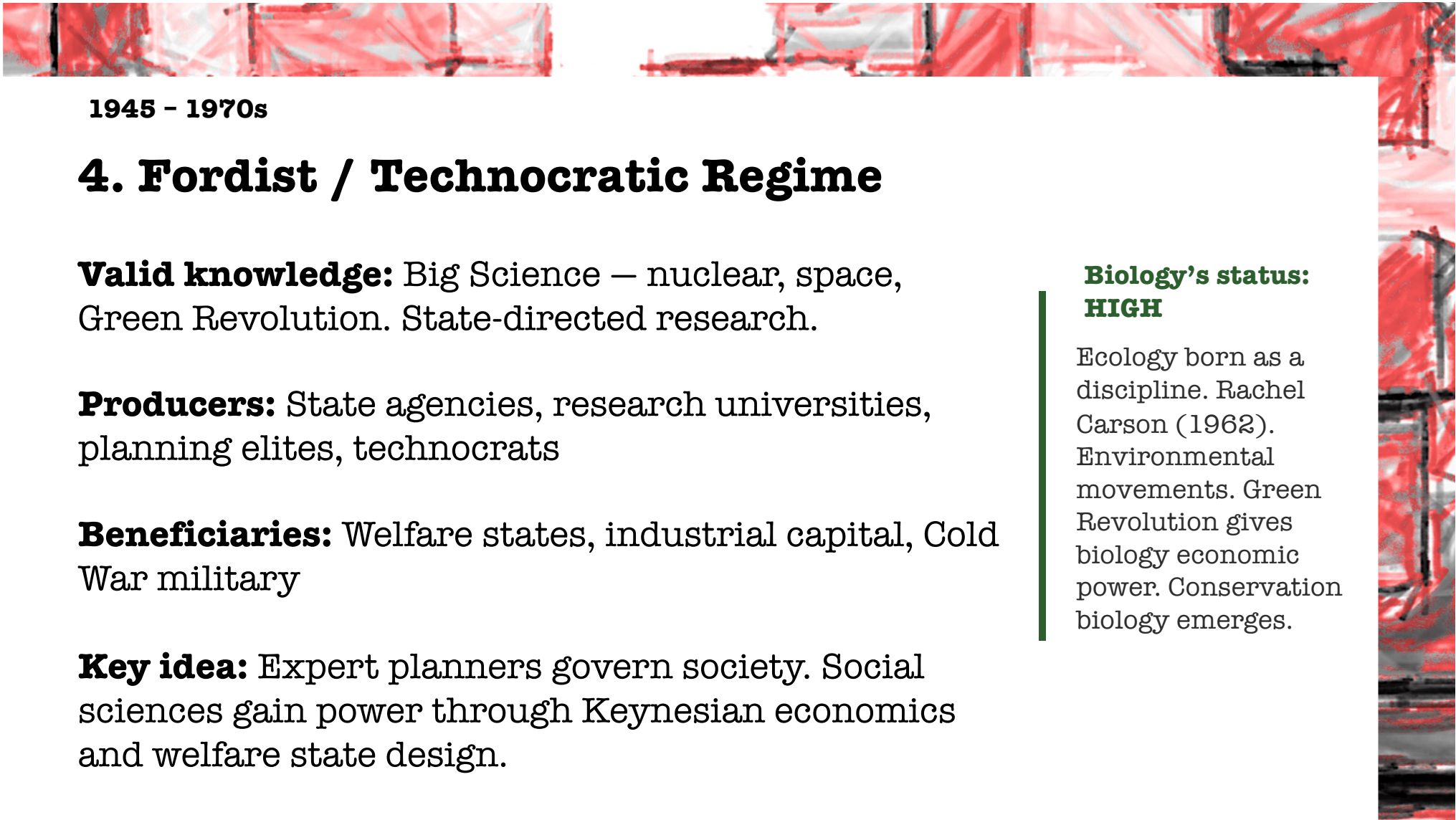
Producers: Engineers, industrial chemists, applied scientists, universities

Beneficiaries: Industrialists, colonial powers, nation-states

Key idea: Knowledge is valued for its productive capacity. Colonialism exports this hierarchy worldwide.

**Biology's
status: MIXED**

Darwin transforms biology. But prestige shifts to engineering and applied chemistry. Natural history becomes "old-fashioned." Biology is respected, but no longer the most powerful discipline.



1945 - 1970s

4. Fordist / Technocratic Regime

Valid knowledge: Big Science – nuclear, space, Green Revolution. State-directed research.


Producers: State agencies, research universities, planning elites, technocrats

Beneficiaries: Welfare states, industrial capital, Cold War military

Key idea: Expert planners govern society. Social sciences gain power through Keynesian economics and welfare state design.

Biology's status:
HIGH

Ecology born as a discipline. Rachel Carson (1962). Environmental movements. Green Revolution gives biology economic power. Conservation biology emerges.



1980s - 2010s

5. Neoliberal / Market-Knowledge Regime

Valid knowledge: Patentable, marketable, scalable.
Knowledge as commodity.

Producers: Corporations, university-industry partnerships, consultants, think tanks

Beneficiaries: Corporations, tech entrepreneurs, venture capital, shareholders

Key idea: The market decides what knowledge is worth. If it can be sold, it is valuable. Morozov's technological solutionism is born here.

Biology
SPLITS:

Molecular biology, genetics, biotech

→ gain power
(patentable!)

Ecology, conservation, field biology

→ lose power (speak of limits)

This split explains the robot bees debate.



2010s - PRESENT

6. Platform / Algorithmic Regime

Valid knowledge: “Data-driven” is the ultimate legitimation. Algorithms claim neutrality.

Producers: Big Tech (Google, Amazon, Meta), data scientists, AI researchers

Beneficiaries: Platform owners, data brokers, surveillance capitalism (Zuboff)

Key idea: Algorithmic knowledge encodes the values of its designers but claims to be neutral and objective.

Ecology's status: LOW

Ecological knowledge is further marginalized. AI and data science dominate. “We can model it” replaces “we must understand it.” Robot bees make sense only in this regime.



From Knowledge Regimes to Robot Bees

Robot bees only make sense inside regimes 5 and 6

In a world where knowledge is judged by its market value and where algorithms claim to solve everything, replacing bees with robots seems logical.

The ecologists' voice has been weakened by the regime shift

Ecologists speak of complexity, limits, and care for nature. In a market-knowledge regime, this language has less power – not because it is wrong, but because it does not generate profit.

The choice between solutions is a choice between regimes

Choosing robot bees = accepting the platform/market regime.
Choosing habitat protection = demanding a different relationship between knowledge, nature, and power.