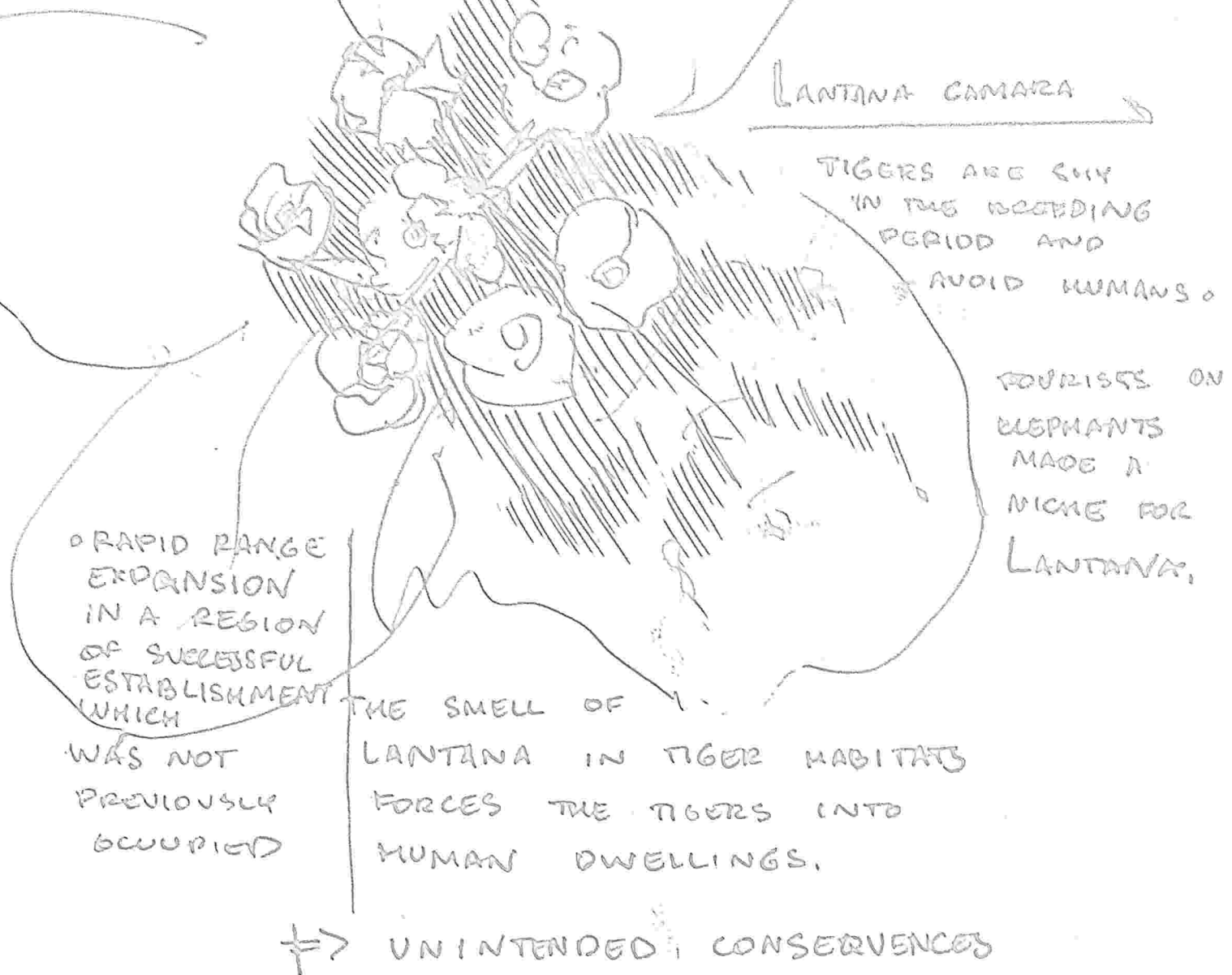


BIO1201 INVASIVE SPECIES  
& CONTEMPORARY EVOLUTION

20161019



II →  
◦ DISRUPTION OF ECOLOGICAL PROCESSES IN  
NATIVE PLANTS AND ANIMAL COMMUNITIES

◦ DISPLACE NATIVE SPECIES LEADING TO THEIR  
EXTINCTION (EG. GOATS DESTROY ALORA OF ISLANDS)

◦ ADVERSE EFFECTS ON HUMAN HEALTH

◦ ECONOMIC & SOCIAL IMPACTS

EG. ↓ YIELDS IN AGRICULTURE & FISHERIES

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INVASIVE SPECIES IN THE USA

◦ ECONOMIC COST : \$ 120 000 / Y

◦ 50 000 SPECIES ARE INTRODUCED

◦ 42 % OF N. ARE AT RISK

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◦ INVASIVE SPECIES ARE AGGRESSIVE IN THE  
INTRODUCED NOT NATIVE RANGES

◦ ARE CERTAIN ECOSYSTEMS MORE SUSCEPTIBLE?

→ HIGH ANTHROPOGENIC DISTURBANCE GIVES I.S. A FOOTHOLD.

◦ WHAT ARE ECOLOGICAL & GENETIC CHARACTERISTICS  
OF SUCCESSFUL INVADERS?

→ OFTEN THE SAME TRAITS ARE OBSERVED

◦ IS THERE EVIDENCE FOR CONTEMPORARY EVOLUTION?

→ RECENT INVADERS ADAPT TO LOCAL ENVIRONMENTS  
METHODS OF CONTROL

FRESHWATER MOLLUSC,  
ZEBRA MUSSELS, ARRIVED  
TO ONTARIO IN  
BALLAST WATER  
OF OCEAN FREIGHTERS

$> 10^{15}$

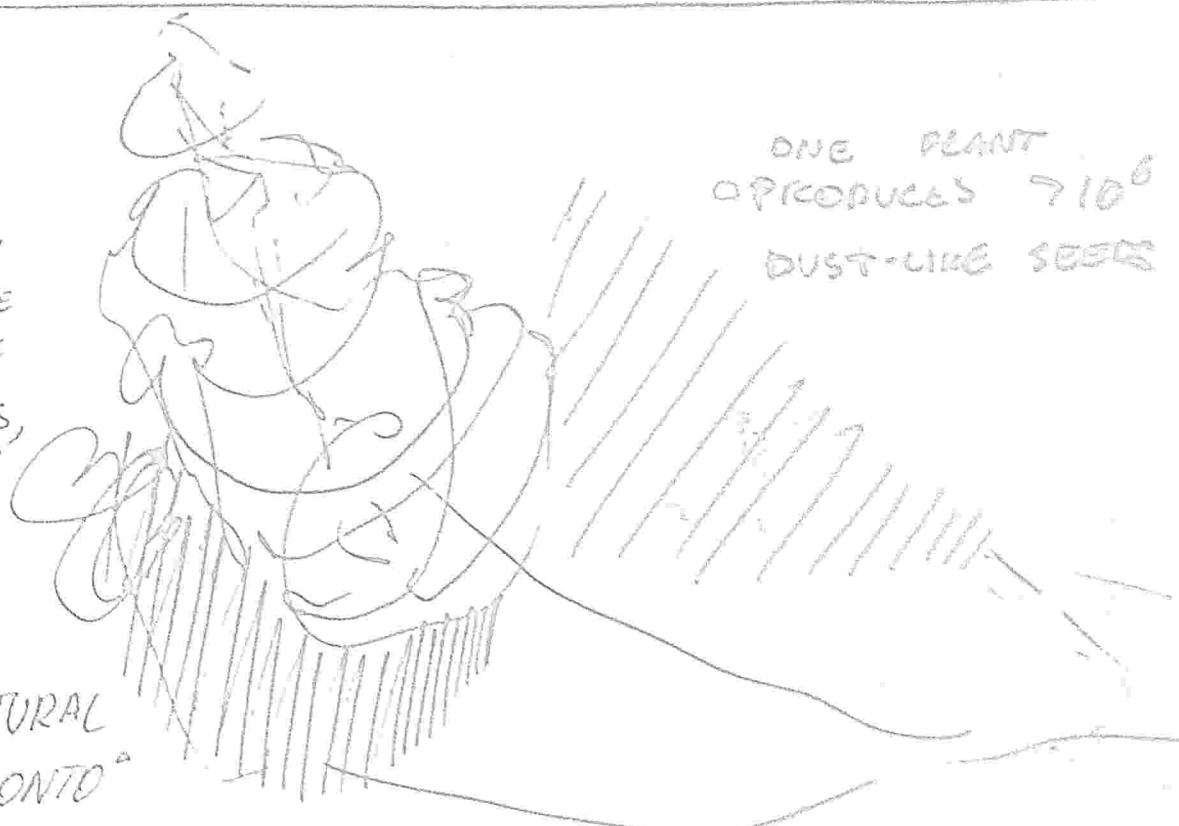
EXTENSIVE DAMAGE TO  
WATER INTAKE PIPES AND  
COMMERCIAL FISHERIES

PURPLE LOOSESTRIFE DEGRADES WETLANDS

POPULATIONS  
GENERICALLY  
DIVERSE DUE  
TO MULTIPLE  
INTRODUCTIONS,  
OUTBREEDING  
AND  
POLYDIPLOIDS

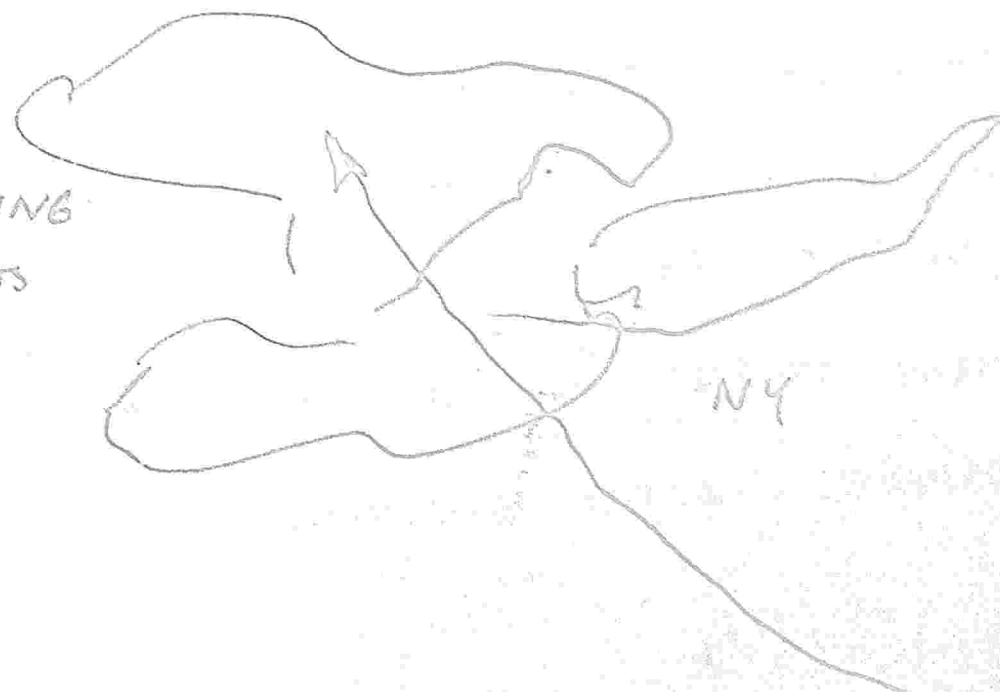
"MULTICULTURAL  
LIKE TORONTO"

ONE PLANT  
PRODUCES  $7 \times 10^6$   
DUST-LIKE SEEDS



EVIDENCE FOR RAPID ADAPTIVE EVOLUTION

FAST FLOWERING  
BEFORE FROGS



## COMMON GARDEN

H<sub>A</sub>: ~~DIFFERENCE~~ GENETIC DIFFERENTIATION EVOLVES  
LEADING TO FASTER FLOWERING

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VARIATION FORMS A CLINE IN TIME TO  
FLOWERING WITH NORTHERN POPULATIONS  
FLOWERING FASTER THAN SOUTHERN  
POPULATIONS

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AQUATIC PLANT INVASION IN THE TROPICS

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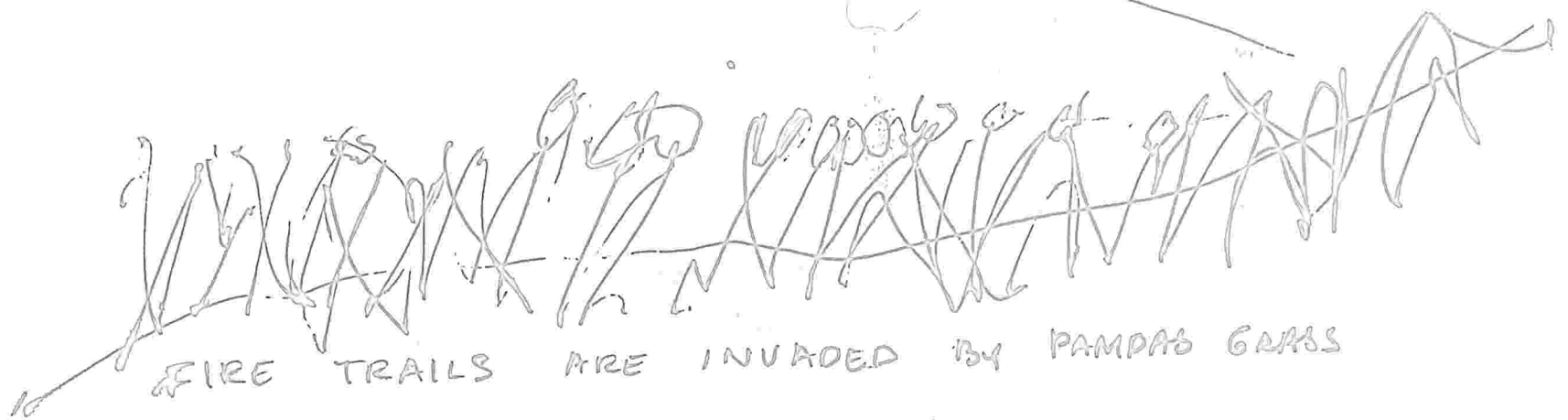
- NATIVE TO SOUTH AMERICA
  - INTRODUCED BY HUMANS TO THE  
OLD WORLD TROPICS
  - FREE-FLOATING WITH PROLIFIC  
CLONAL PROPAGATION
  - HIGH INVASIVENESS DUE TO  
PHENOTYPIC PLASTICITY
- 

KARIBA WEED : CERN

- COMPLETELY STERILE DUE TO PENTAPLOIDISM
- OUTCOMPETES WATER HYACINTH

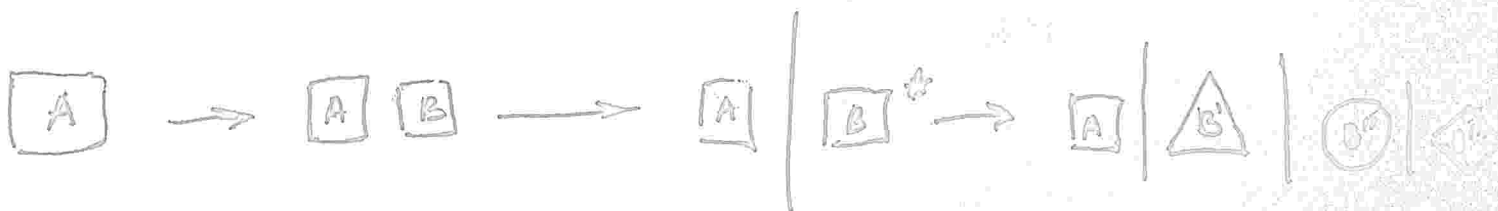
LORNE  
WOLFE

LEVEL OF ENEMY ATTACK (PEST & DISEASE  
PRESSURE) IS 17 TIMES HIGHER  
IN THE NATIVE RANGE.



TRAITS FOR SUCCESSFUL INVASION:

- RAPID DEVELOPMENT TO REPRODUCTION
- HIGH REPRODUCTIVE OUTPUT
- WELL-DEVELOPED DISPERSAL MECHANISM
- BROAD ECOLOGICAL TOLERANCE
- HIGH PHENOTYPIC PLASTICITY



# EVOLUTION IN INVASIVE SPECIES OF AGRICULTURE

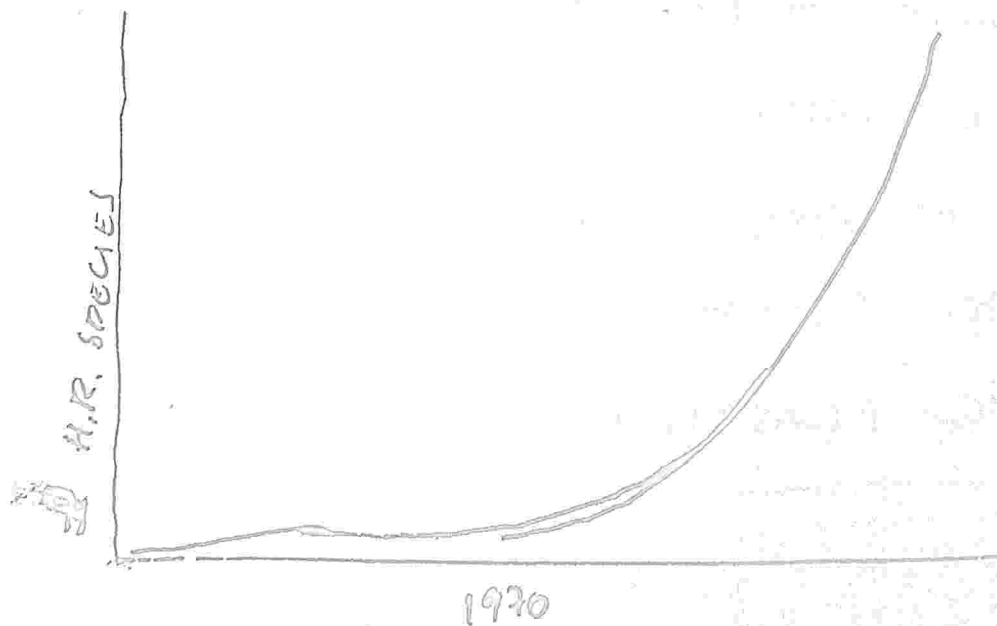
PROFESSOR BARRETT → SWAZILAND 1969



MANUAL WEEDING  
INTRODUCES STRONG  
SELECTIVE PRESSURE  
WHICH LEADS TO  
THE BIOMIMICRY  
EVOLUTION  
OF WEEDS.

RICE VS BARNYARD  $\Rightarrow$  INADVERTENT NATURAL  
SELECTION OF A MEMETIC  
FORM

RAPID EVOLUTION OF HERBICIDE RESISTANT WEEDS  
IN AGRICULTURE



## BIOLOGICAL CONTROL

PLANNED INTRODUCTION OF ENEMIES TO  
CONTROL UNWANTED POPULATIONS OF  
INVADERS IN A GIVEN RANGE

→ MUST BE MOST SPECIFIC  
⇔ CATERPILLAR EXPERIMENTS

| ~ 10 YEARS

• ASEXUAL SPECIES ARE EASIER TO CONTROL

→ INFLUENCE OF REPRODUCTIVE SYSTEMS ON  
GENETIC DIVERSITY.

RESISTANCE ↑ FOR SEXUALLY REPRODUCING  
SPECIES

## BIOLOGICAL CONTROL:

+ CHEAP

+ EFFECTS ARE PERMANENT IF SUCCESSFUL

= RISK OF A NEW INVASIVE SPECIES