Direct and indirect effects of agriculture and drought on shorebird refueling in the Prairie Pothole Region

Shelby McCahon, University of Idaho
Courtney Conway, U.S. Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho
Katie Christie, Alaska Department of Fish and Game
Christy Morrissey, University of Saskatchewan

Prairie Pothole Region: Important stopover for millions of shorebirds

How does agriculture and drought impact shorebirds?

Artist: Ruth Weaver

- Quantify insecticide exposure and accumulation in shorebirds

How does agriculture and drought impact shorebirds?

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- Quantify insecticide exposure and accumulation in shorebirds
- Measure direct and indirect effects of agriculture and drought on shorebirds and their prey

How does agriculture and drought impact shorebirds?

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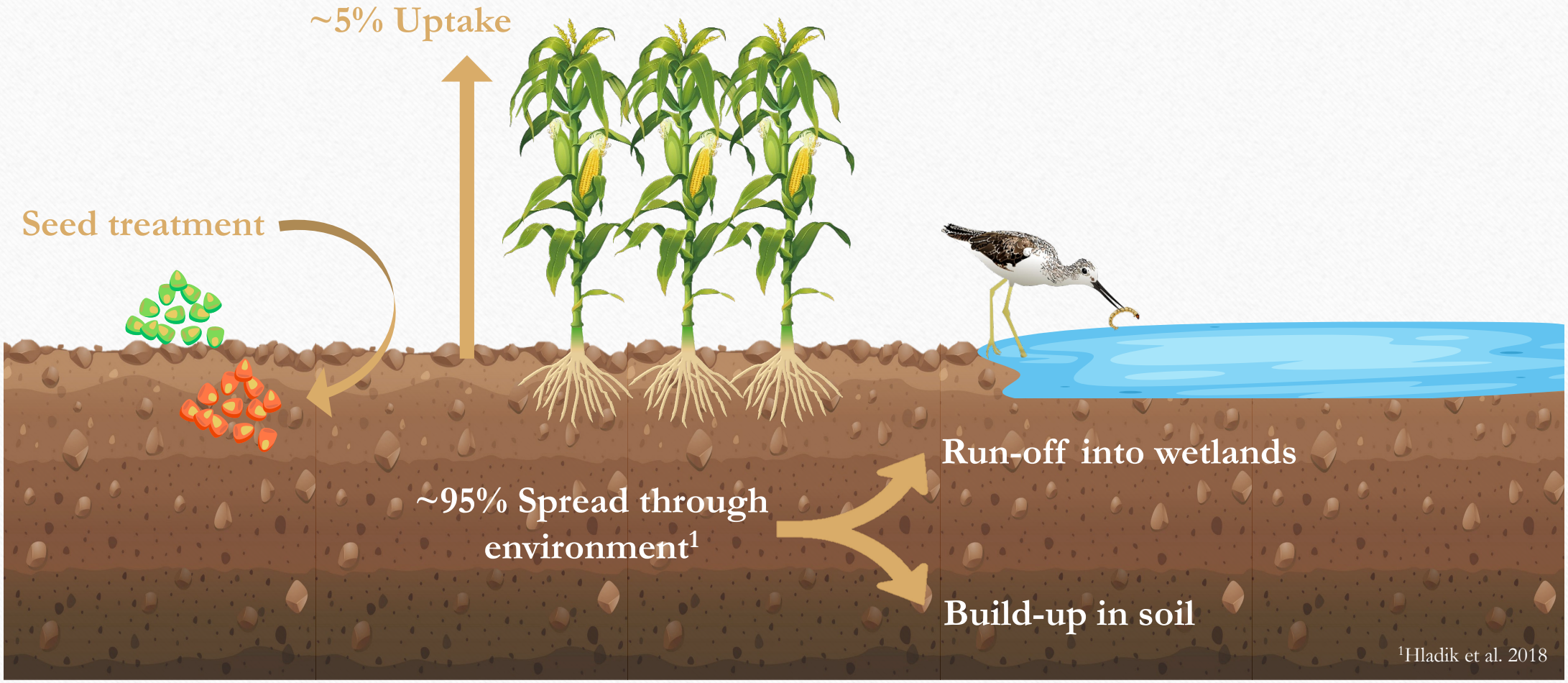
Neonicotinoid Insecticides

Neonicotinoid (Neonic) Transport

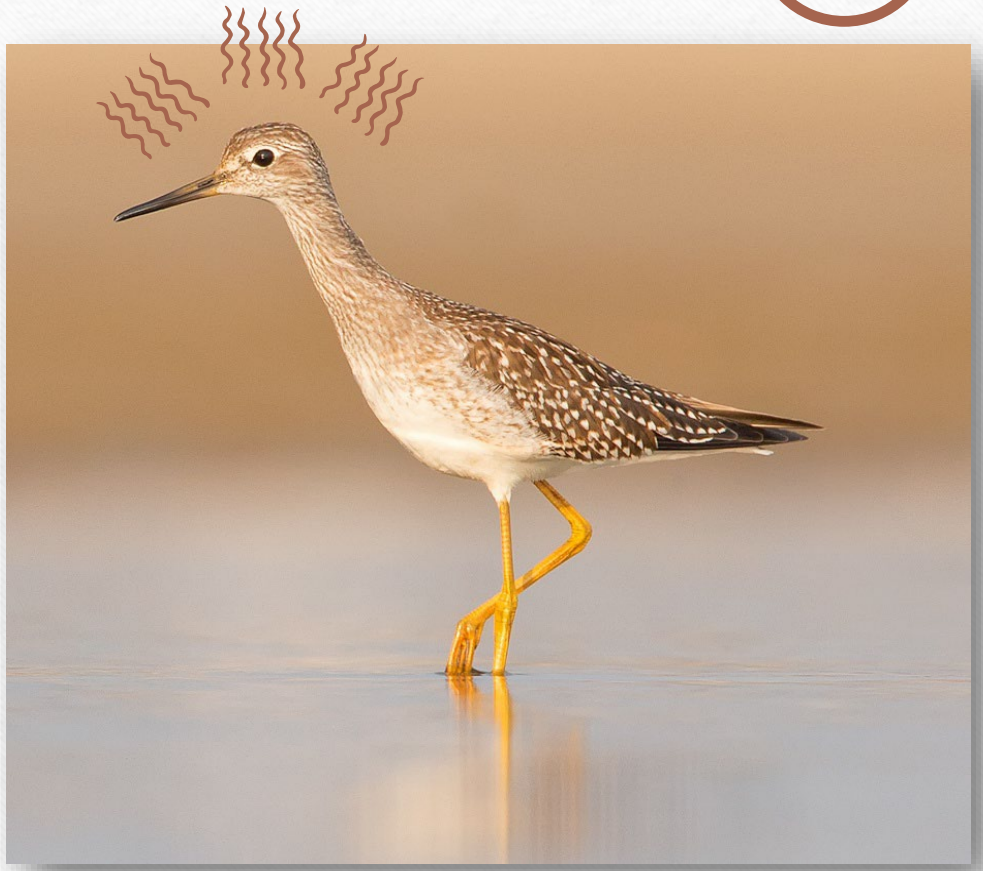


Less Appetite

Less Food

Rapid Body Mass & Fat Loss

Rapidly Metabolized



Wetland Surveys
(2021-2023)

Shorebird Capture
(2021-2023)

Invertebrate Collection
(2023 only)

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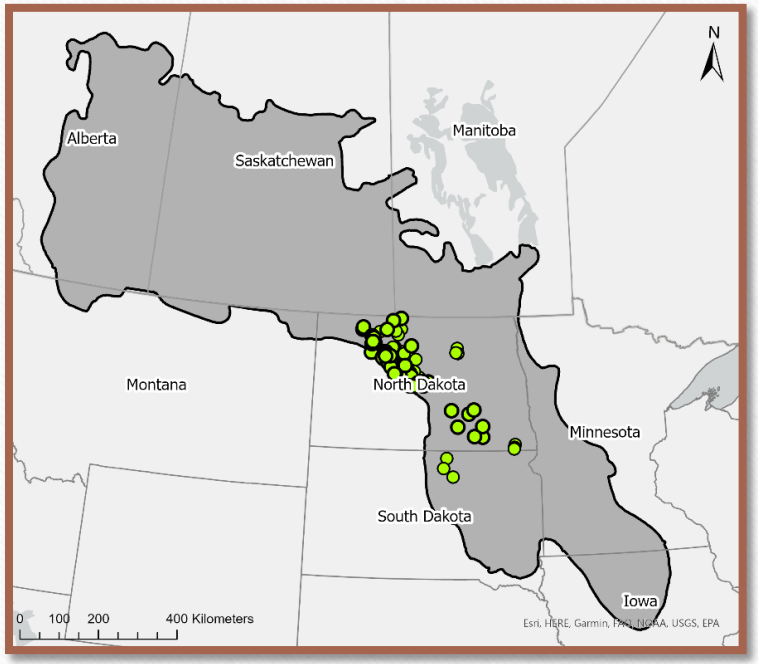
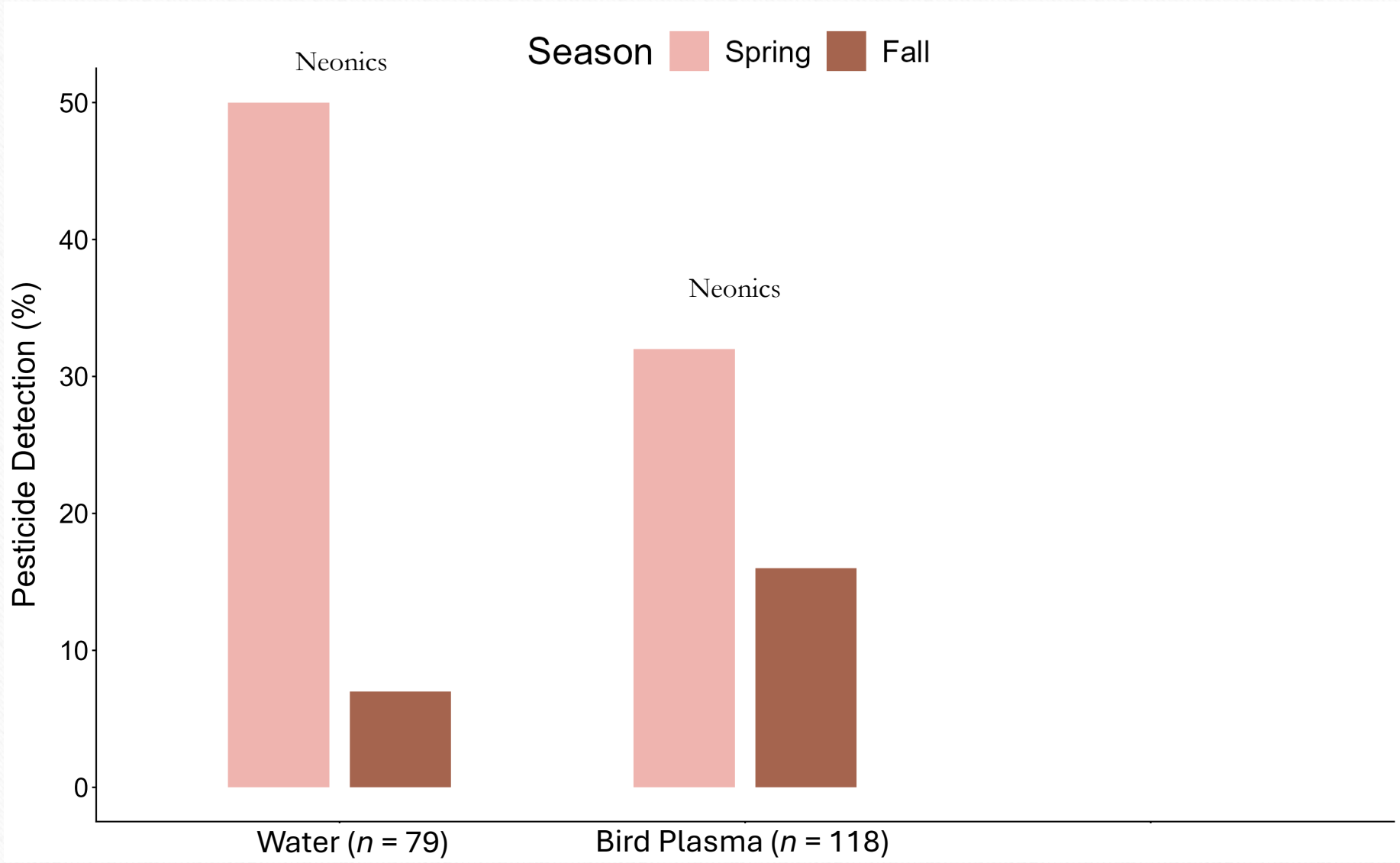
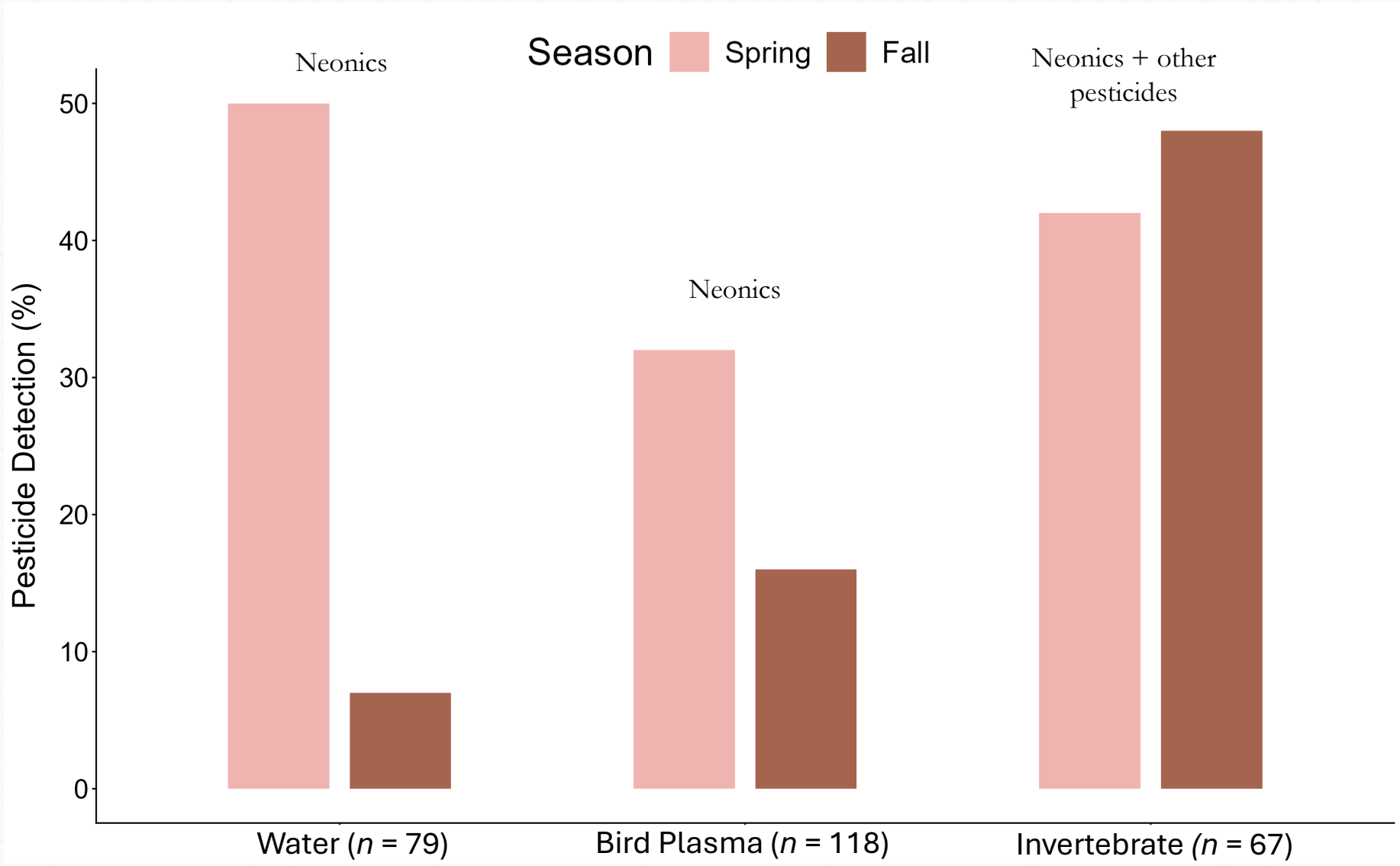
Spring and Fall Migration



2023


Season
Spring
Fall
Neonics
Neonics
Pesticide Detection (%)
50
40
30
20
10
0
Water (n = 79)
Bird Plasma (n = 118)

2023


Season
Spring
Fall
Neonics
Neonics
Neonics + other pesticides
Pesticide Detection (%)
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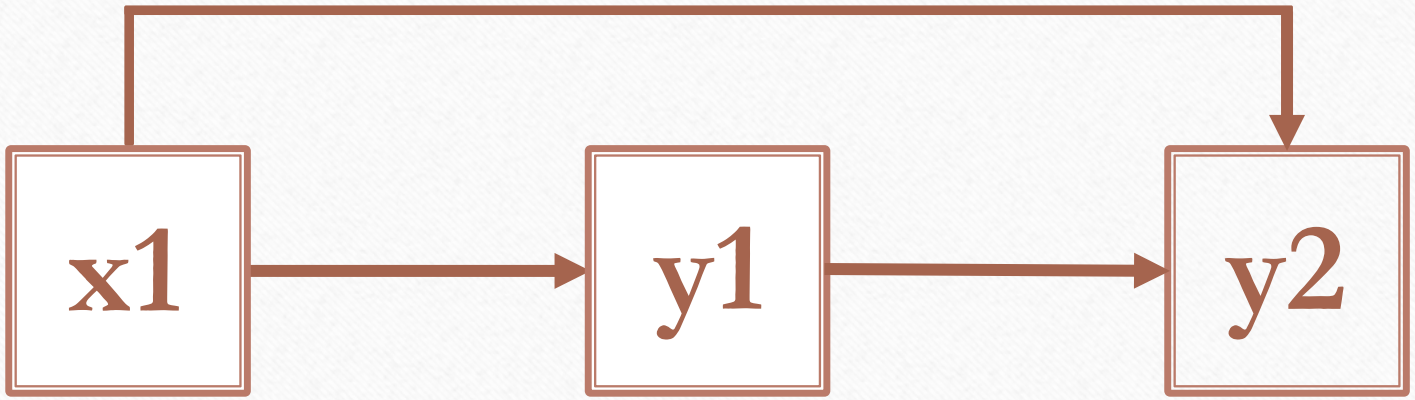
40
50
Water (n = 79)
Bird Plasma (n = 118)
Invertebrate (n = 67)

Structural Equation Modeling (SEM)



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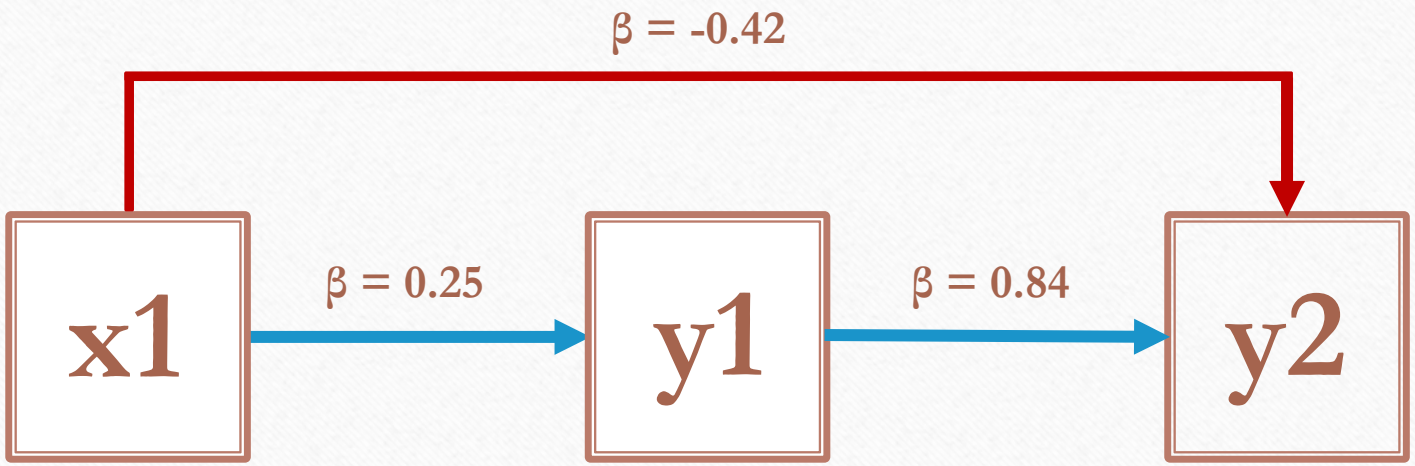

SEM 1: Agricultural effects on body condition and prey availability (2023 dataset)

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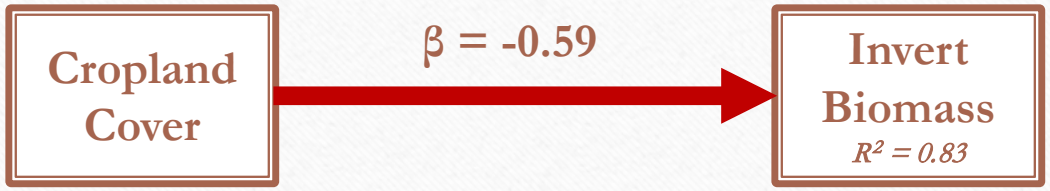

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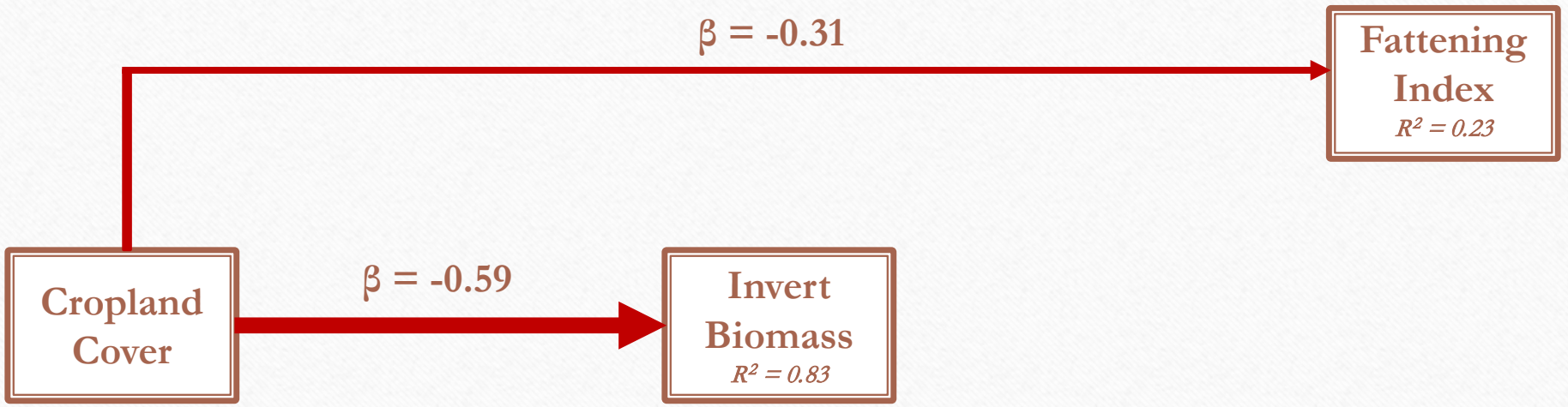

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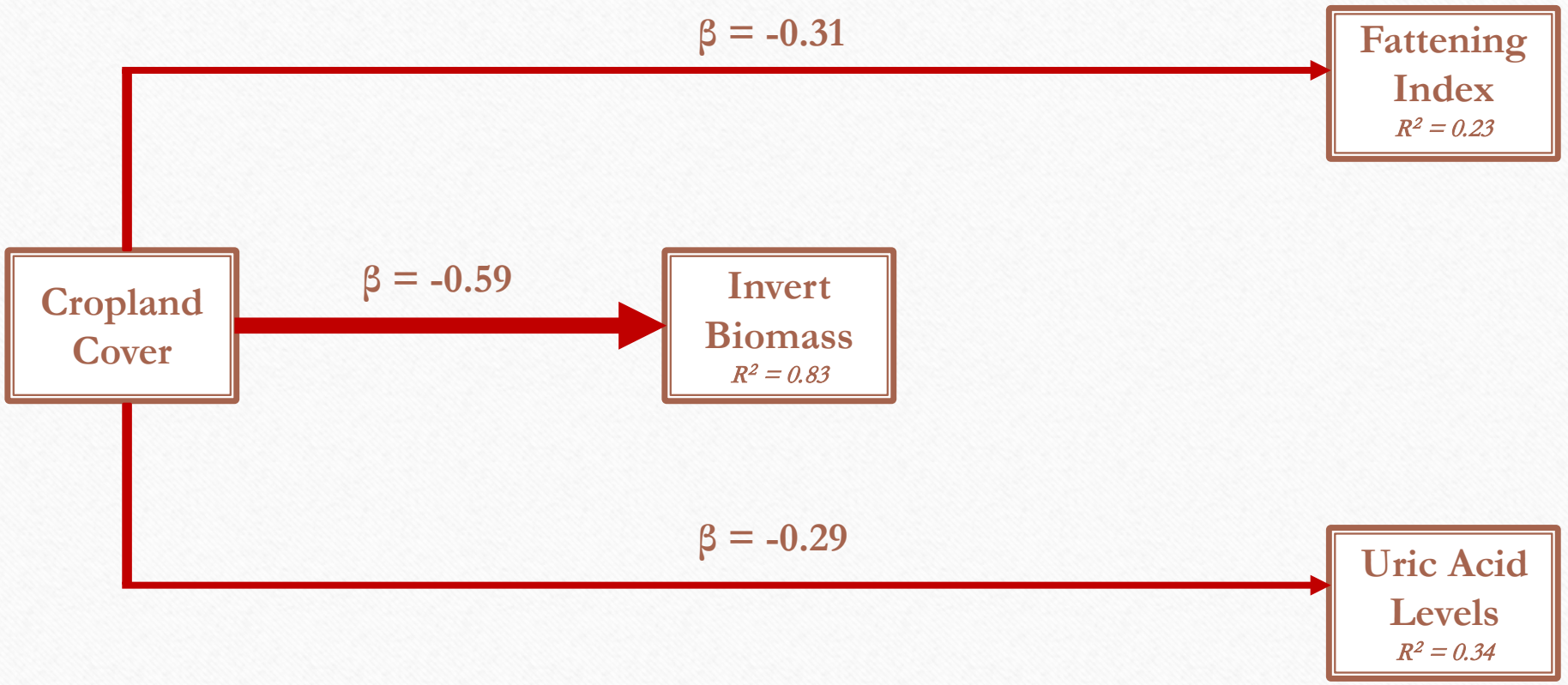

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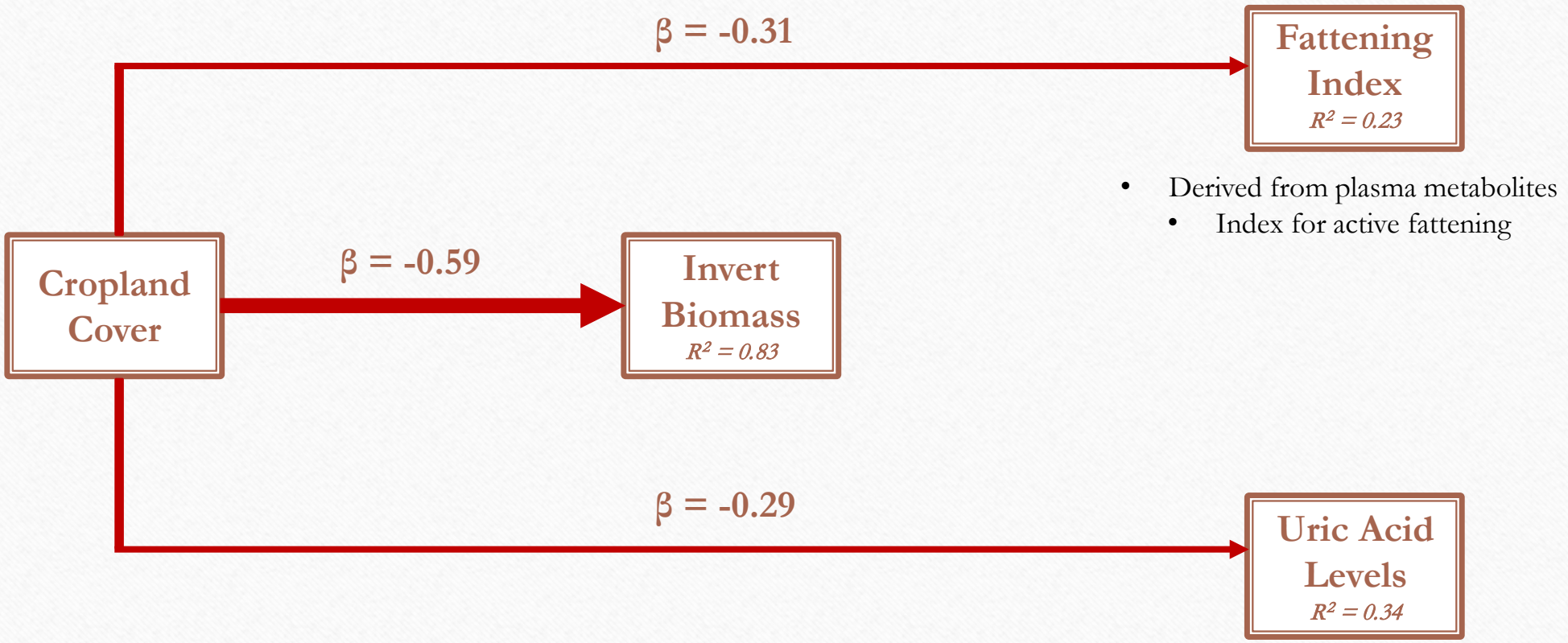

- Derived from plasma metabolites
- Index for active fattening

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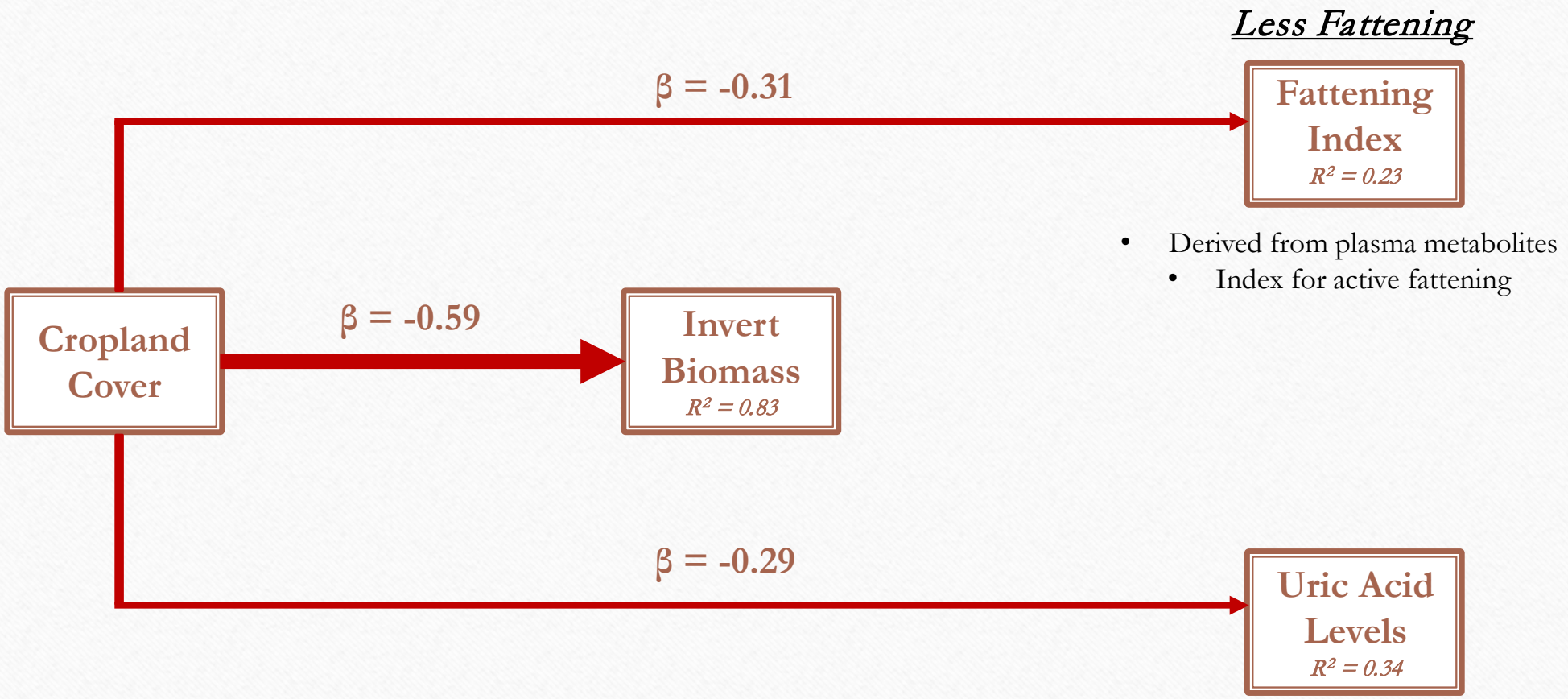

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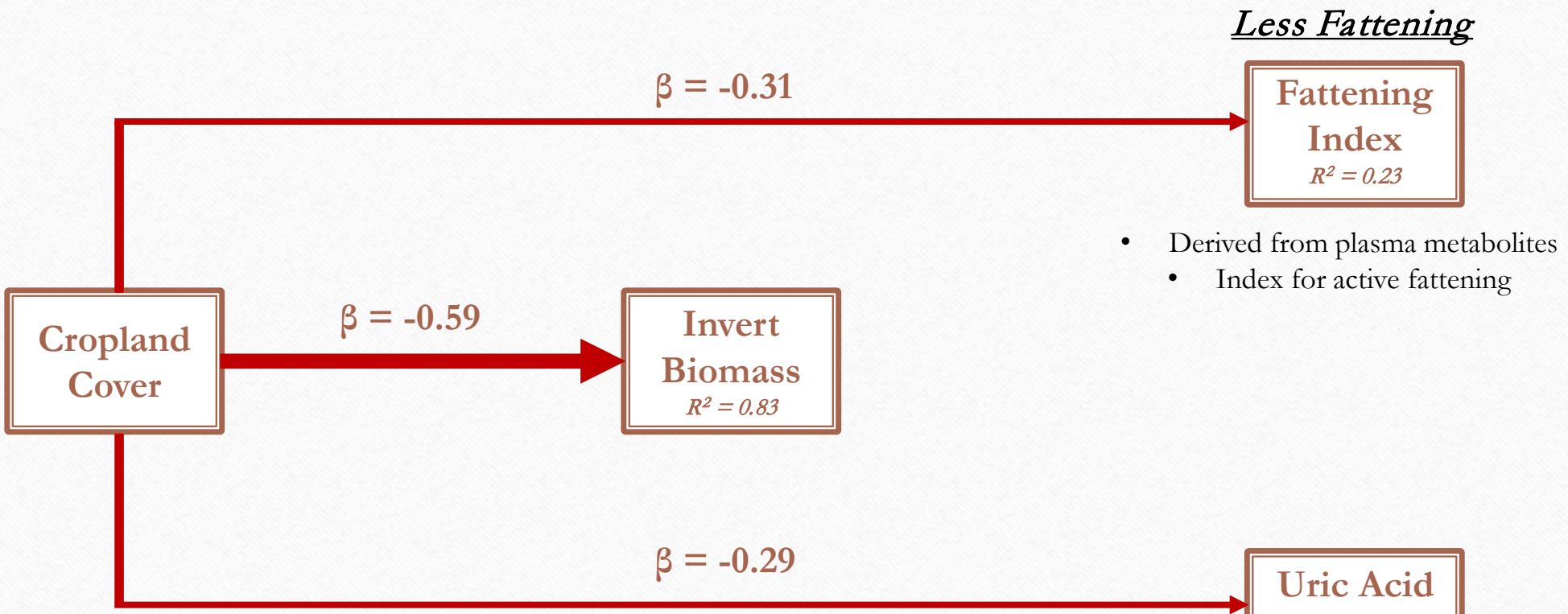

- Derived from plasma metabolites
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- Derived from plasma
- Index for protein catabolism

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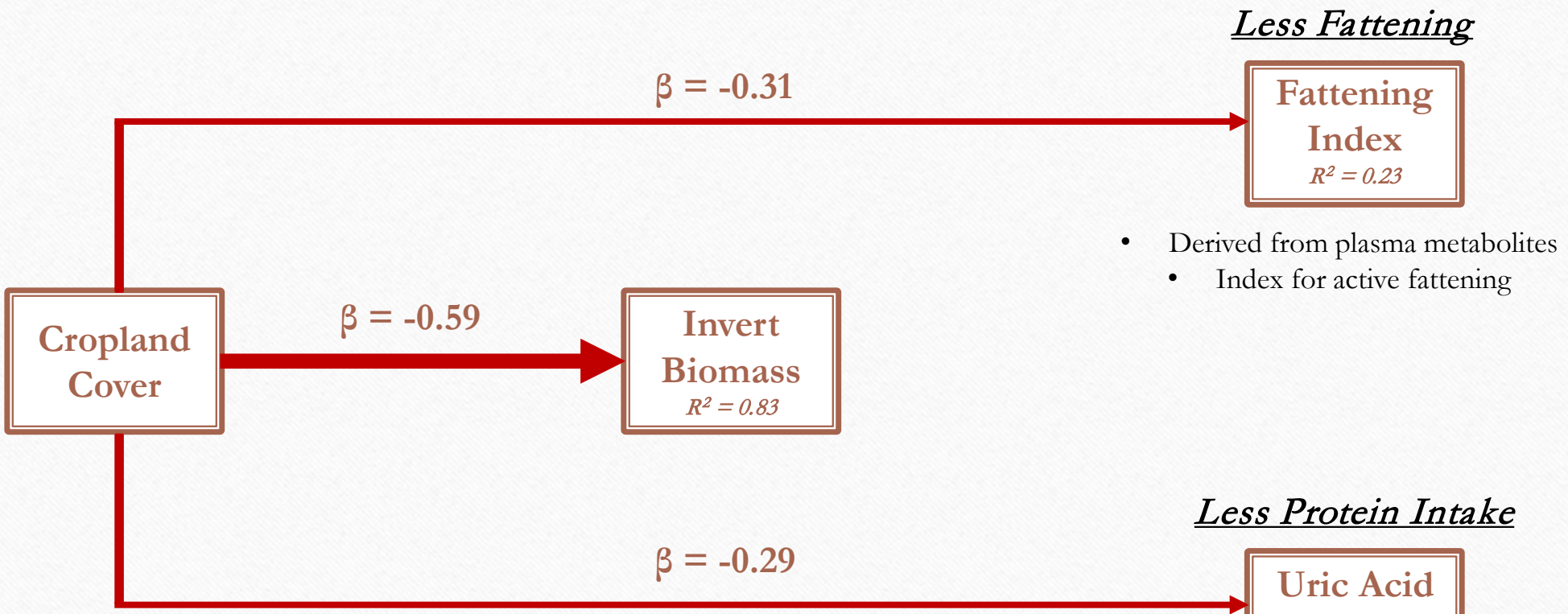

Less Fattening

- Derived from plasma metabolites
- Index for active fattening

Less Protein Intake

- Derived from plasma
- Index for protein catabolism

SEM 2: Agricultural and drought effects on body condition across years (2021-2023 dataset)

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Drought Index

- Higher = wetter-than-average

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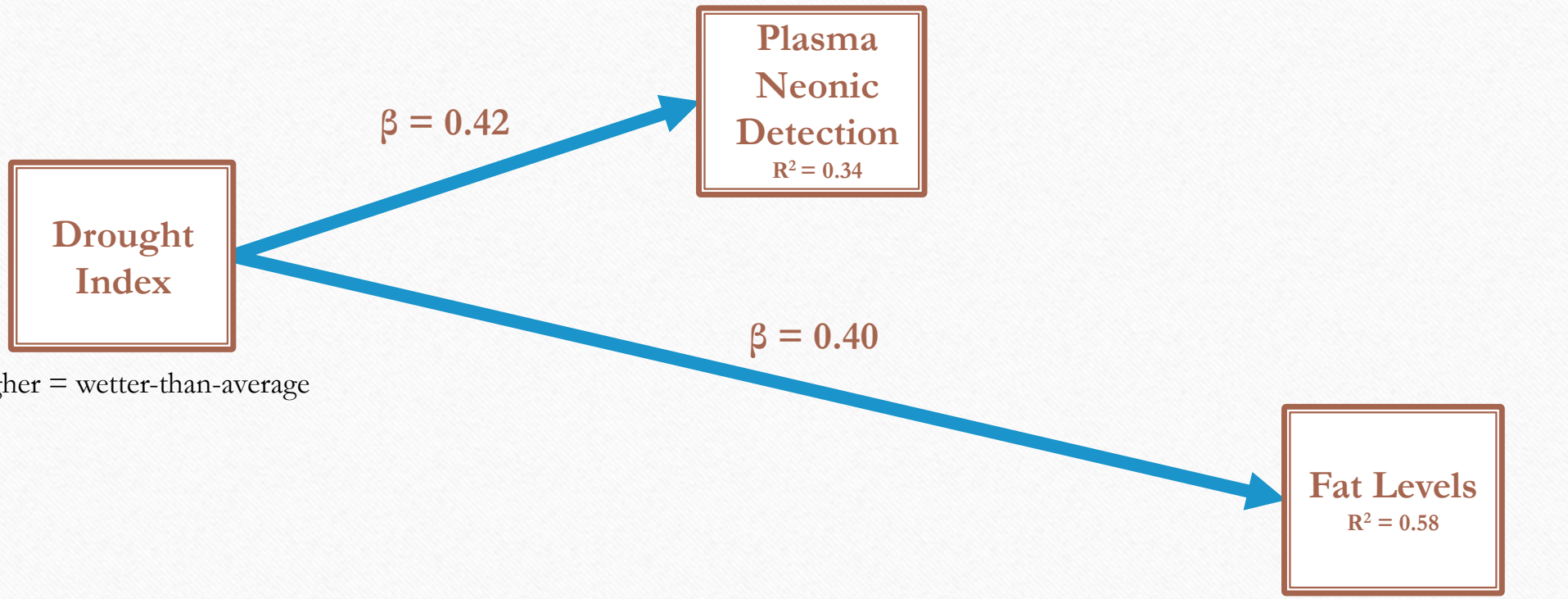

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- Fat in interclavicular region

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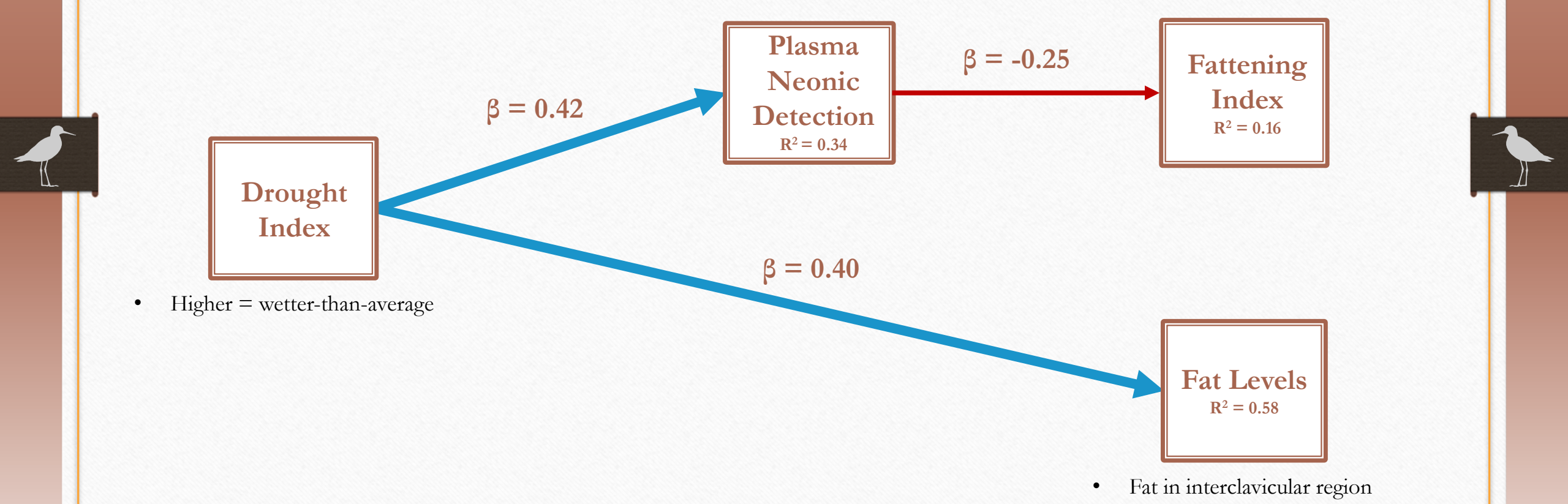

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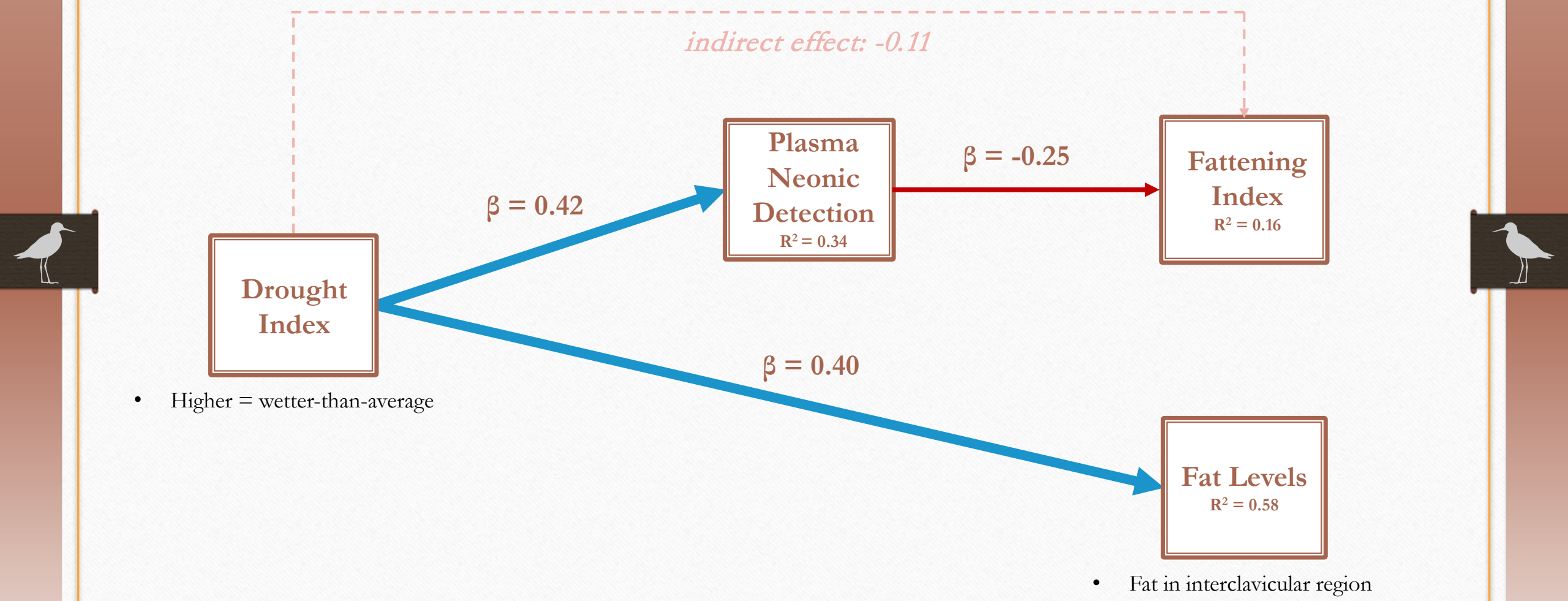

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- Neonic/pesticide detections in ≤ 50% of samples
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- Lower fattening and uric acid levels in birds with neonic detections
- Higher neonic detections and fat levels in wetter conditions

Agriculture and drought cumulatively impact shorebirds and their prey

How does agriculture and drought impact shorebirds?

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Thank you!
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