CmapTools Facilitates Alignment of Local Curriculum with State Standards: A Case Study

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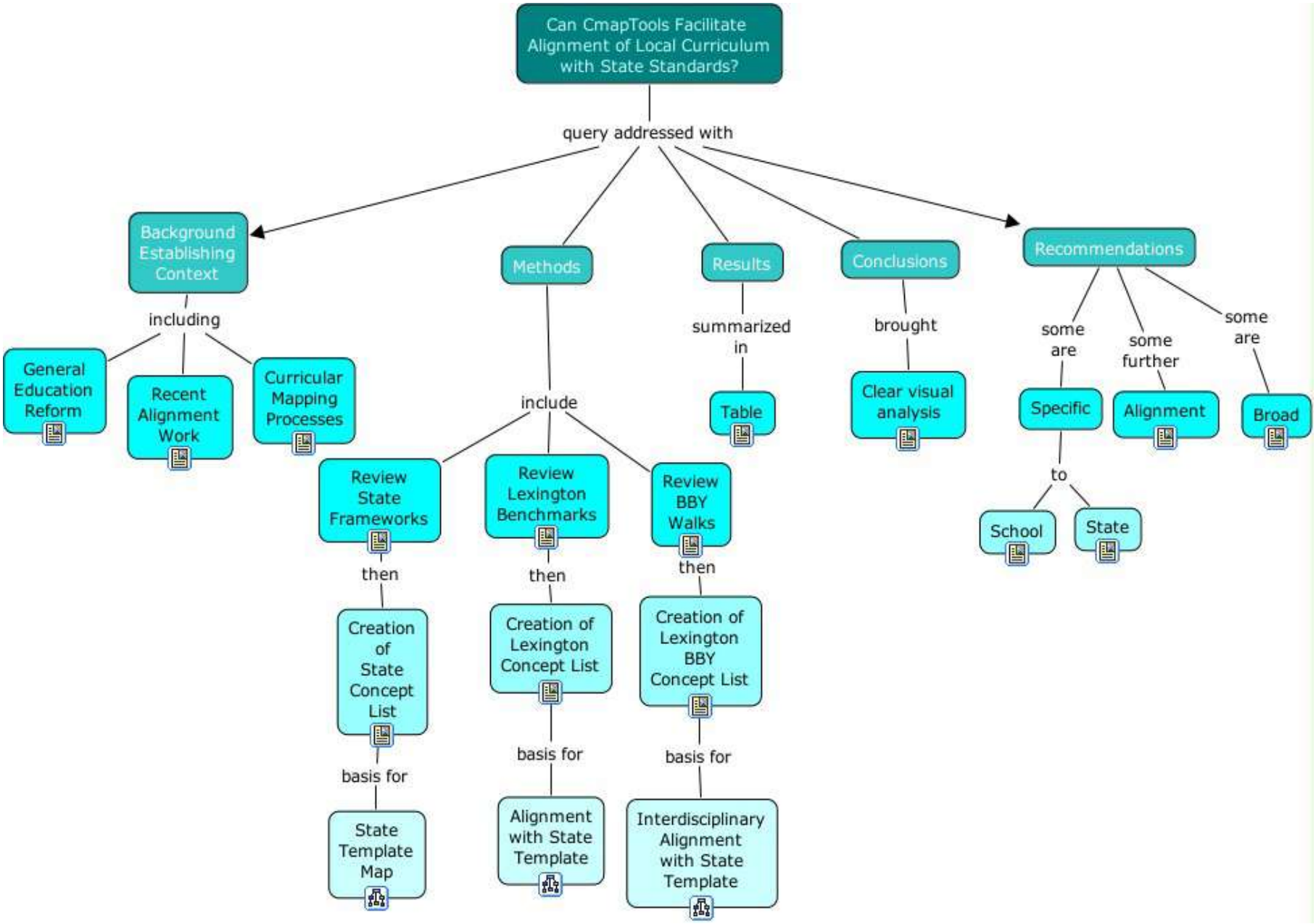

Can CmapTools Facilitate Alignment of Local Curriculum with State Standards?
query addressed with
Background Establishing Context
including
General Education Reform
Recent Alignment Work
Curricular Mapping Processes
Methods
include
Review State Frameworks
then
Creation of State Concept List
basis for
State Template Map
Review Lexington Benchmarks
then
Creation of Lexington Concept List
basis for
Alignment with State Template
Review BBY Walks
then
Creation of Lexington BBY Concept List
basis for
Interdisciplinary Alignment with State Template
Results
summarized in
Table
Conclusions
brought
Clear visual analysis
Recommendations
some are
Specific
to
School
State
some further
Alignment
some are
Broad

Context: USA Timeline

- A Nation at Risk: the Imperative for Education Reform by the National Commission on Excellence in Education, 1983
- Benchmarks for Science Literacy: Project 2061, American Association for the Advancement of Science, 1993
- National Science Education Standards, National Research Council, 1996
- No Child Left Behind Legislation, 2002

Context: Alignment

- Align to Achieve, facilitates evaluation and improvement of academic standards and student achievement
- Science Curriculum Topic Study, Page Keeley, 2005 facilitates teachers' efforts to link to the standards and to current research on student learning about different science topics

Context: Mapping Strategies

- "Curriculum Mapping" *Mapping the Big Picture: Integrating Curriculum & Assessment K-12* (Heidi Hayes, 1997)

- "Content Mapping" New Tools for Analyzing Teaching, Curriculum and Standards in Mathematics & Science (Blank, Porter, and Smithson, 2001)

- *"Strand Maps" Atlas of Science Literacy: Project 2061,* 2001, American Association for the Advancement of Science

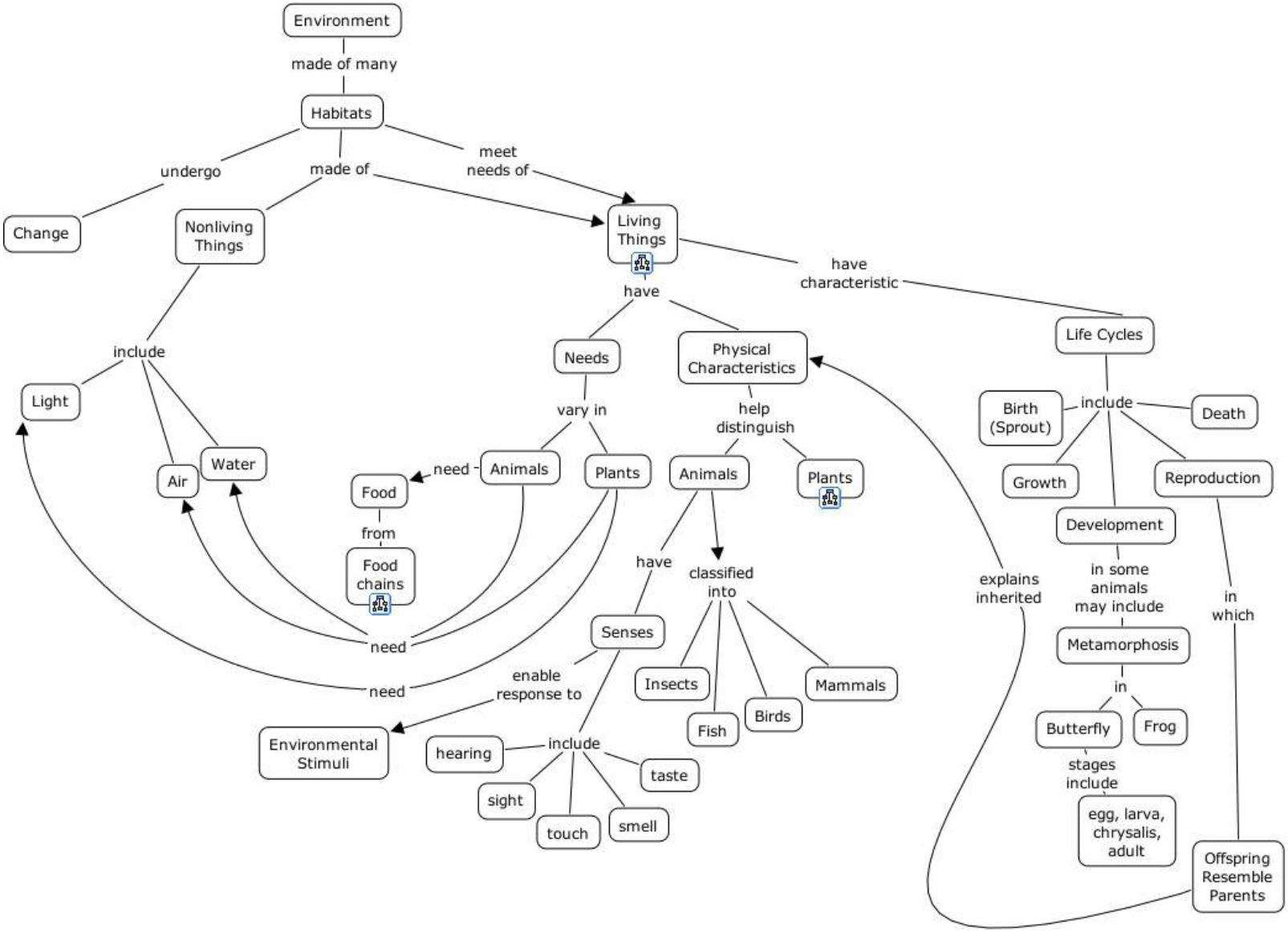
Context: Lexington, Massachusetts

- Science and Technology/Engineering Curriculum Framework, 2000
- Language and Mathematics currently required for High School Graduation. Science requirement becomes high stakes in 2010.
- Lexington Elementary Science Benchmarks: goals and objectives of the Lexington Public Schools
- Lexington Big Backyard: an interdisciplinary program integrating science and history concepts

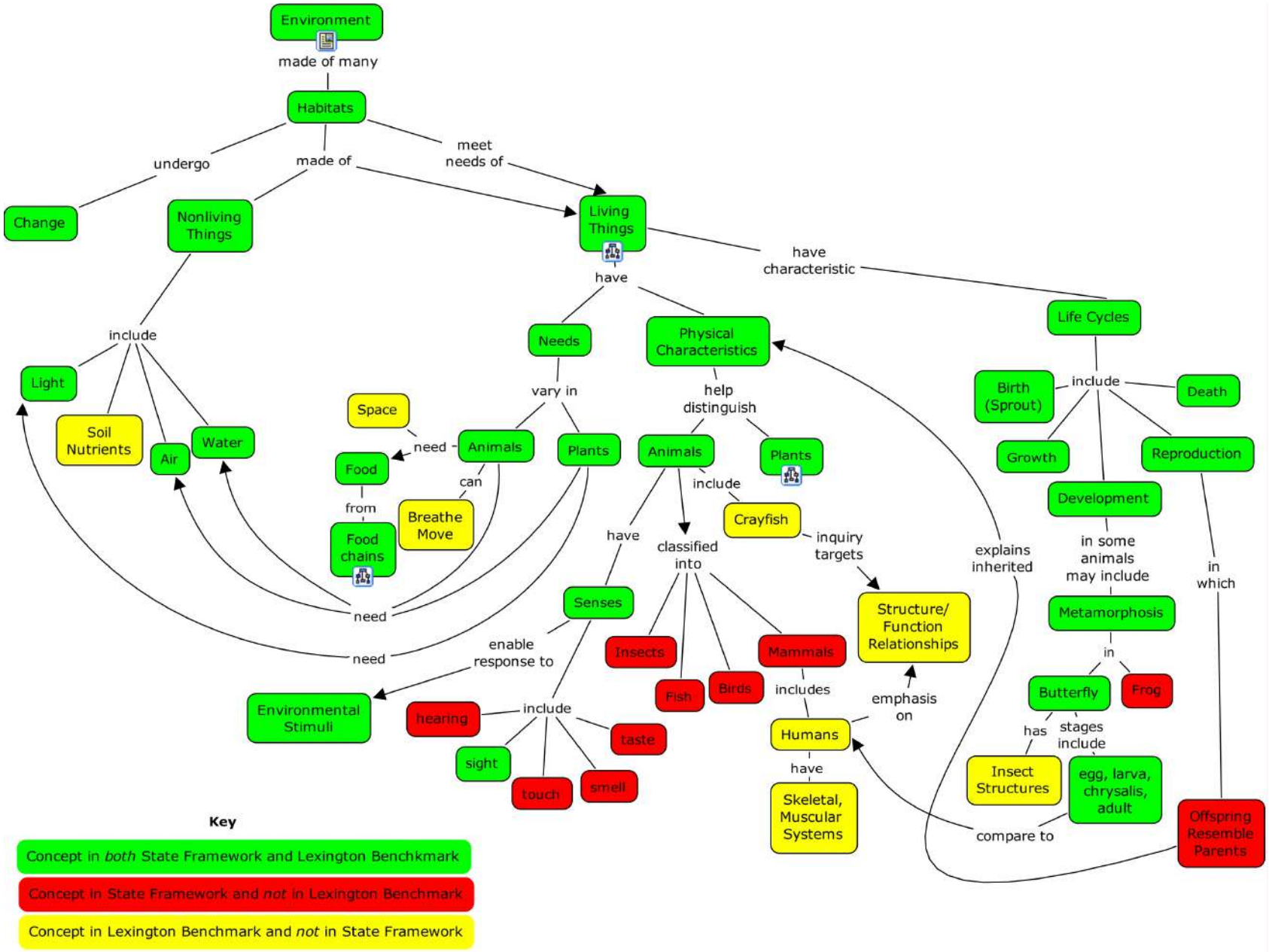
? The Question ?

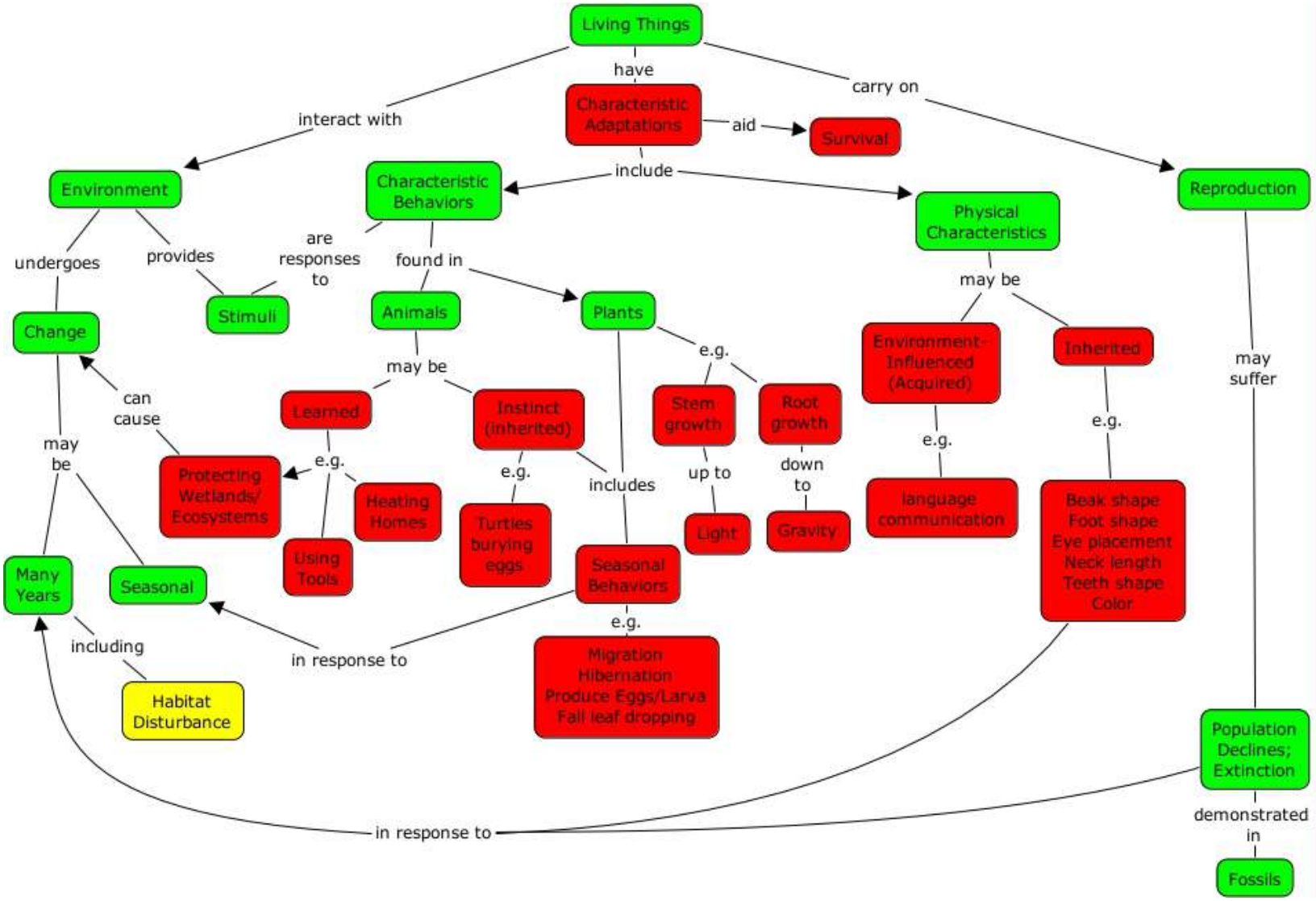
Can CmapTools effectively demonstrate the alignment of the local life science curriculum with the state life science standards?

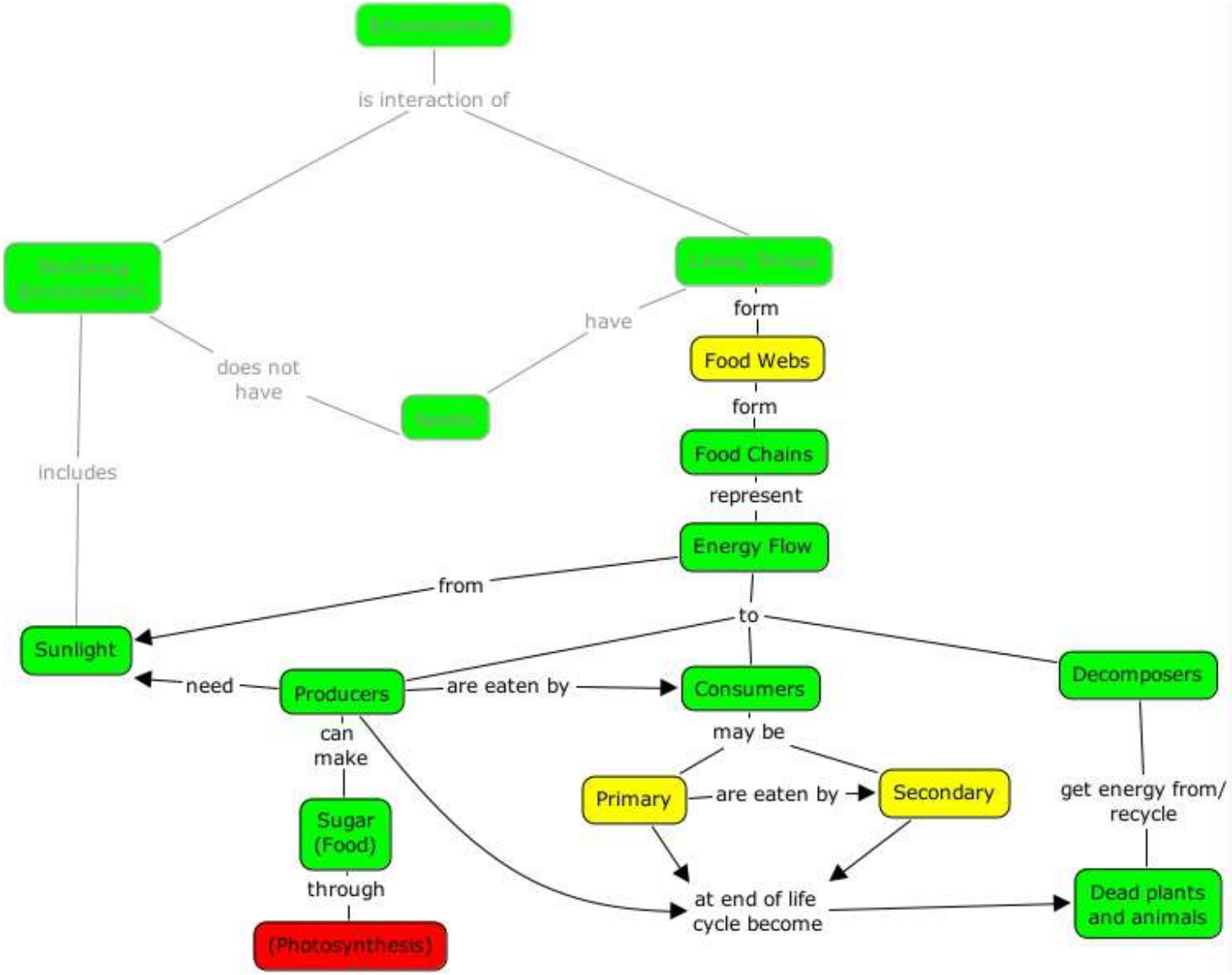
Massachusetts Template

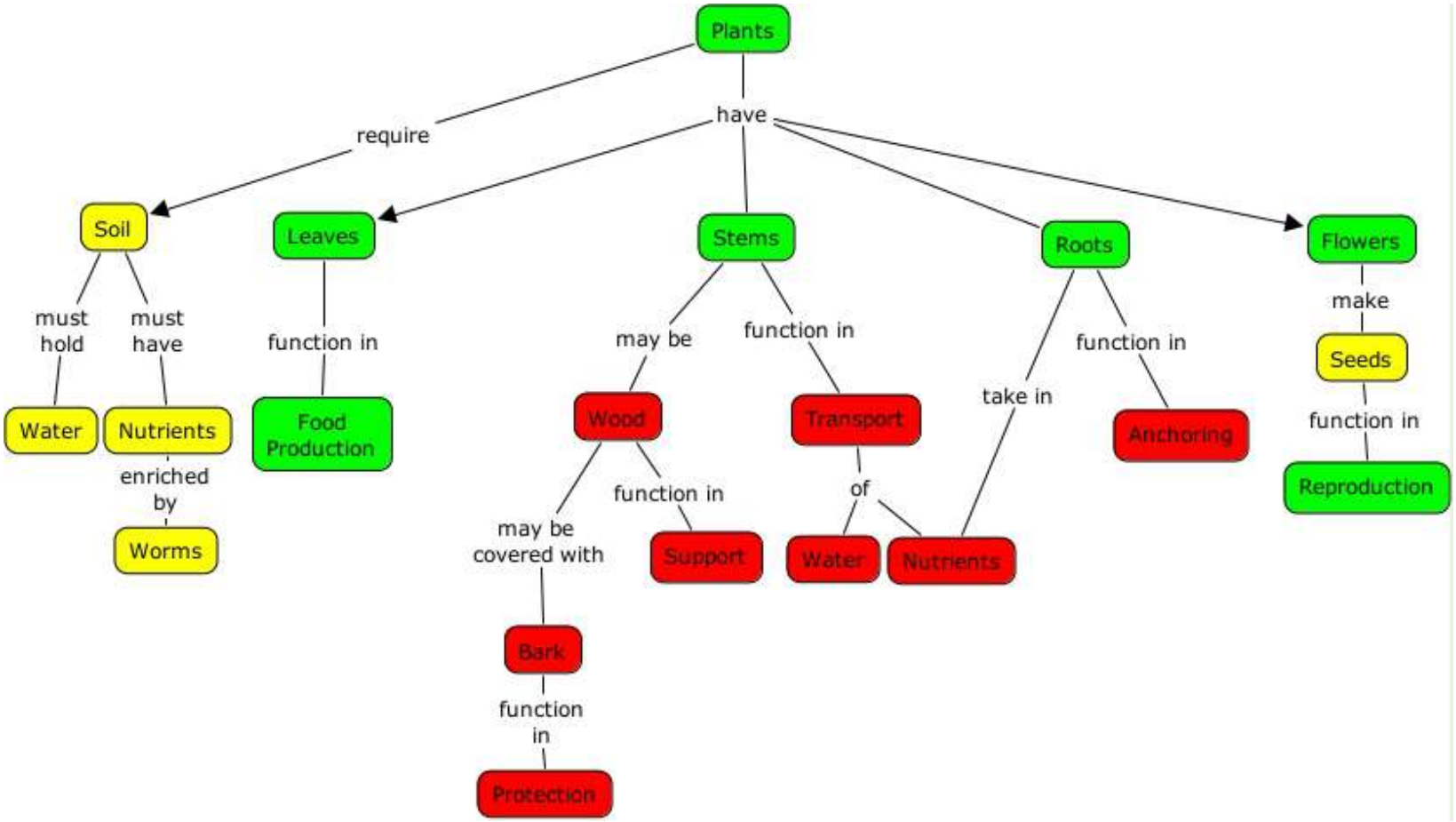


Alignment: Lexington Benchmarks



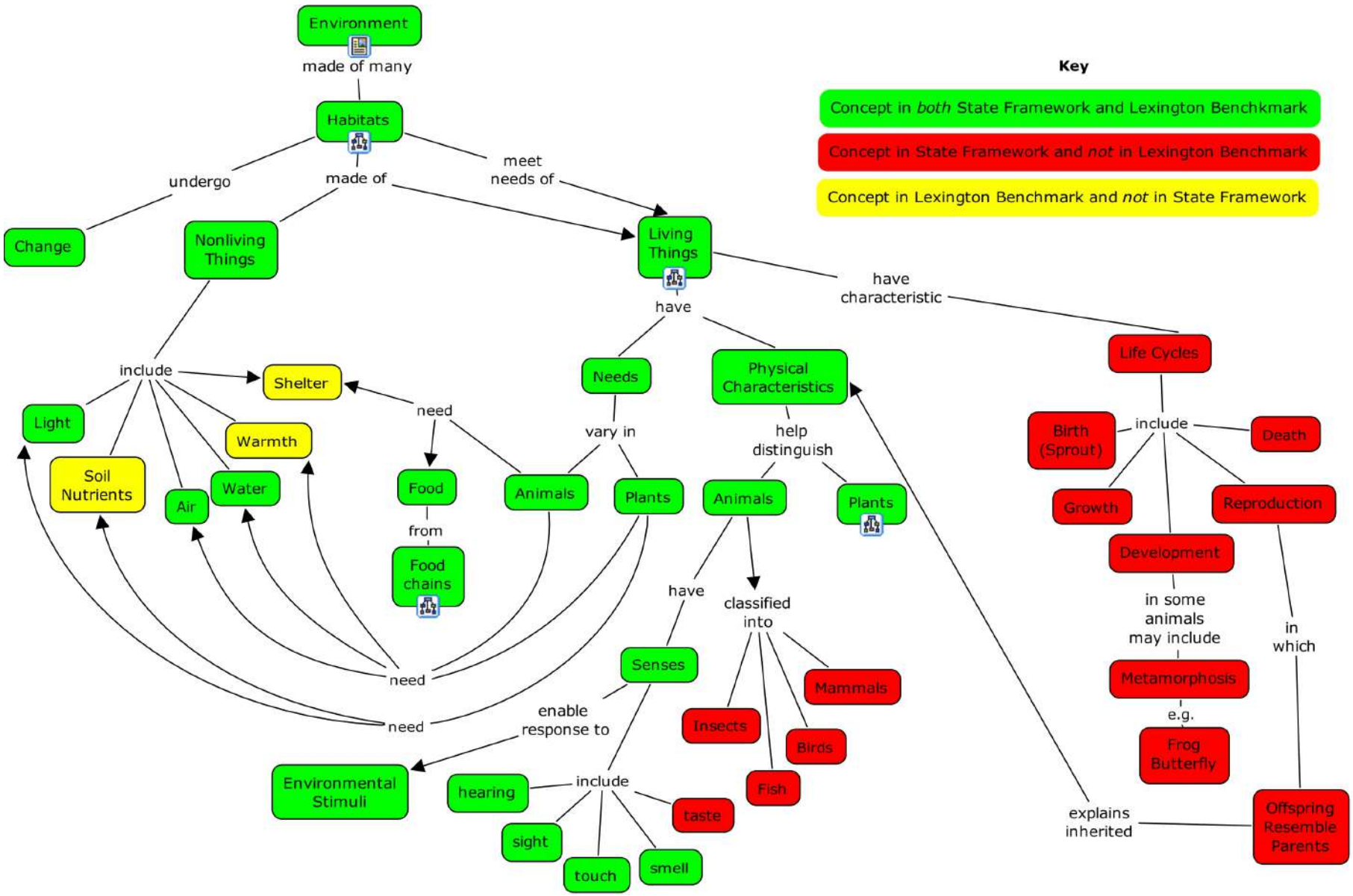

Living Things
have
interact with
carry on
Characteristic Adaptations
aid
Survival
include
Environment
Characteristic Behaviors
Physical Characteristics
Reproduction
undergoes
provides
are responses to
found in
may be
Change
Stimuli
Animals
Plants
Environment-Influenced (Acquired)
Inherited
may suffer
e.g.
may be
can cause
Learned
Instinct (inherited)
Stem growth
Root growth
e.g.
e.g.
e.g.
Protecting Wetlands/ Ecosystems
Heating Homes
Using Tools
Turtles burying eggs
includes
up to
down to
Light
Gravity
language communication
Beak shape
Foot shape
Eye placement
Neck length
Teeth shape
Color
Many Years
Seasonal
Seasonal Behaviors
including
in response to
e.g.
Habitat Disturbance
Migration
Hibernation
Produce Eggs/Larva
Fall leaf dropping
Population Declines; Extinction
demonstrated in
Fossils
in response to

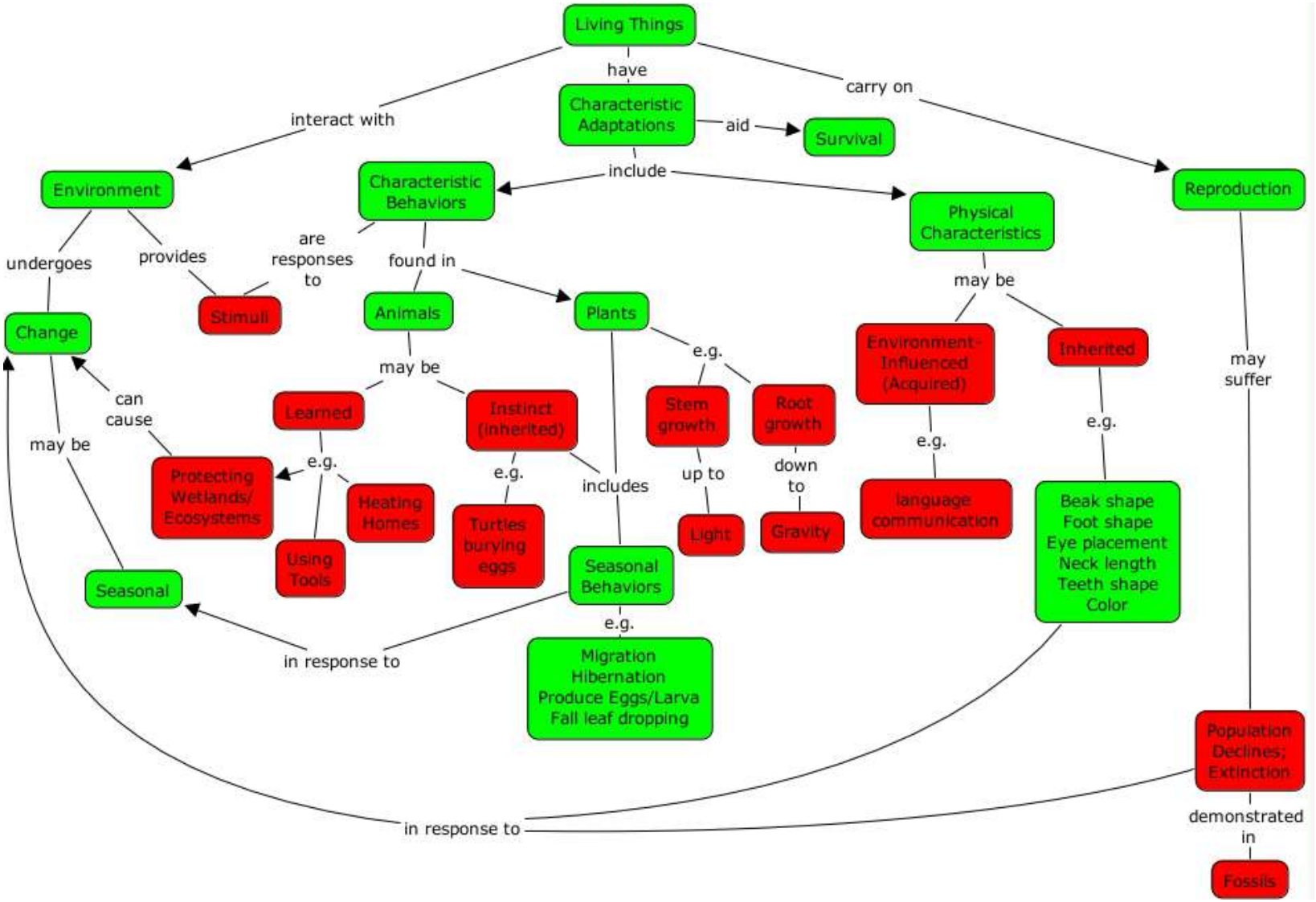

is interaction of
includes
does not have
have
form
Food Webs
form
Food Chains
represent
Energy Flow
from
to
Sunlight
need
Producers
are eaten by
Consumers
Decomposers
can make
Sugar (Food)
through
(Photosynthesis)
may be
Primary
are eaten by
Secondary
get energy from/ recycle
at end of life cycle become
Dead plants and animals


Plants
require
have
Soil
Leaves
Stems
Roots
Flowers
must hold
must have
function in
may be
function in
take in
function in
make
Water
Nutrients
Food Production
Wood
Transport
Anchoring
Seeds
enriched by
function in
Worms
may be covered with
function in
of
Reproduction
Support
Water
Nutrients
Bark
function in
Protection

Results: % Alignment

Alignment: Big Backyard




Living Things
have
interact with
carry on
Characteristic Adaptations
aid
Survival
Environment
include
Characteristic Behaviors
Physical Characteristics
Reproduction
undergoes
provides
are responses to
found in
may be
Change
Stimuli
Animals
Plants
Environment-Influenced (Acquired)
Inherited
may suffer
e.g.
may be
can cause
Learned
Instinct (inherited)
Stem growth
Root growth
e.g.
e.g.
e.g.
Protecting Wetlands/ Ecosystems
Heating Homes
Using Tools
Turtles burying eggs
includes
up to
down to
language communication
Beak shape
Foot shape
Eye placement
Neck length
Teeth shape
Color
Light
Gravity
Seasonal
Seasonal Behaviors
in response to
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Migration
Hibernation
Produce Eggs/Larva
Fall leaf dropping
Population Declines; Extinction
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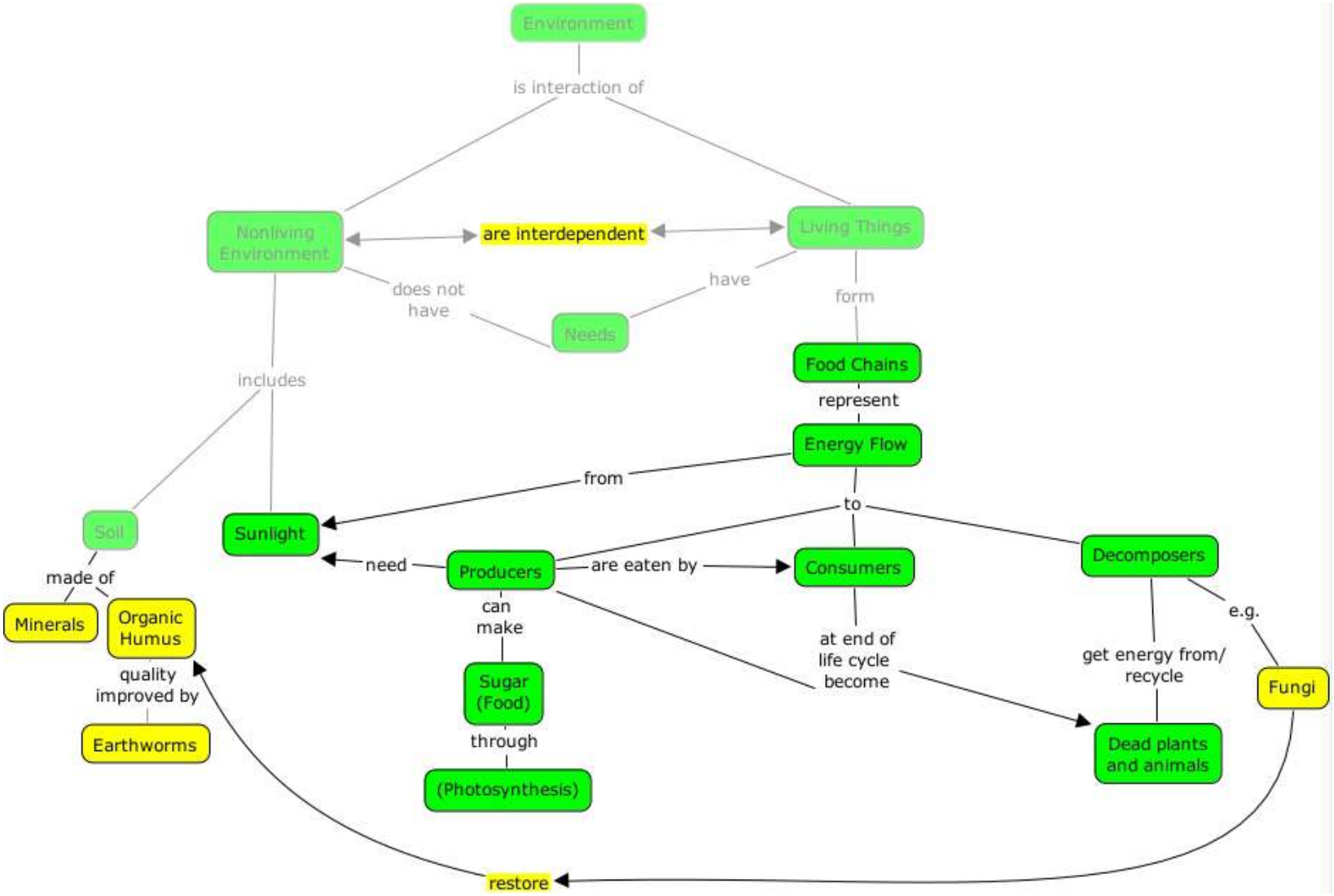
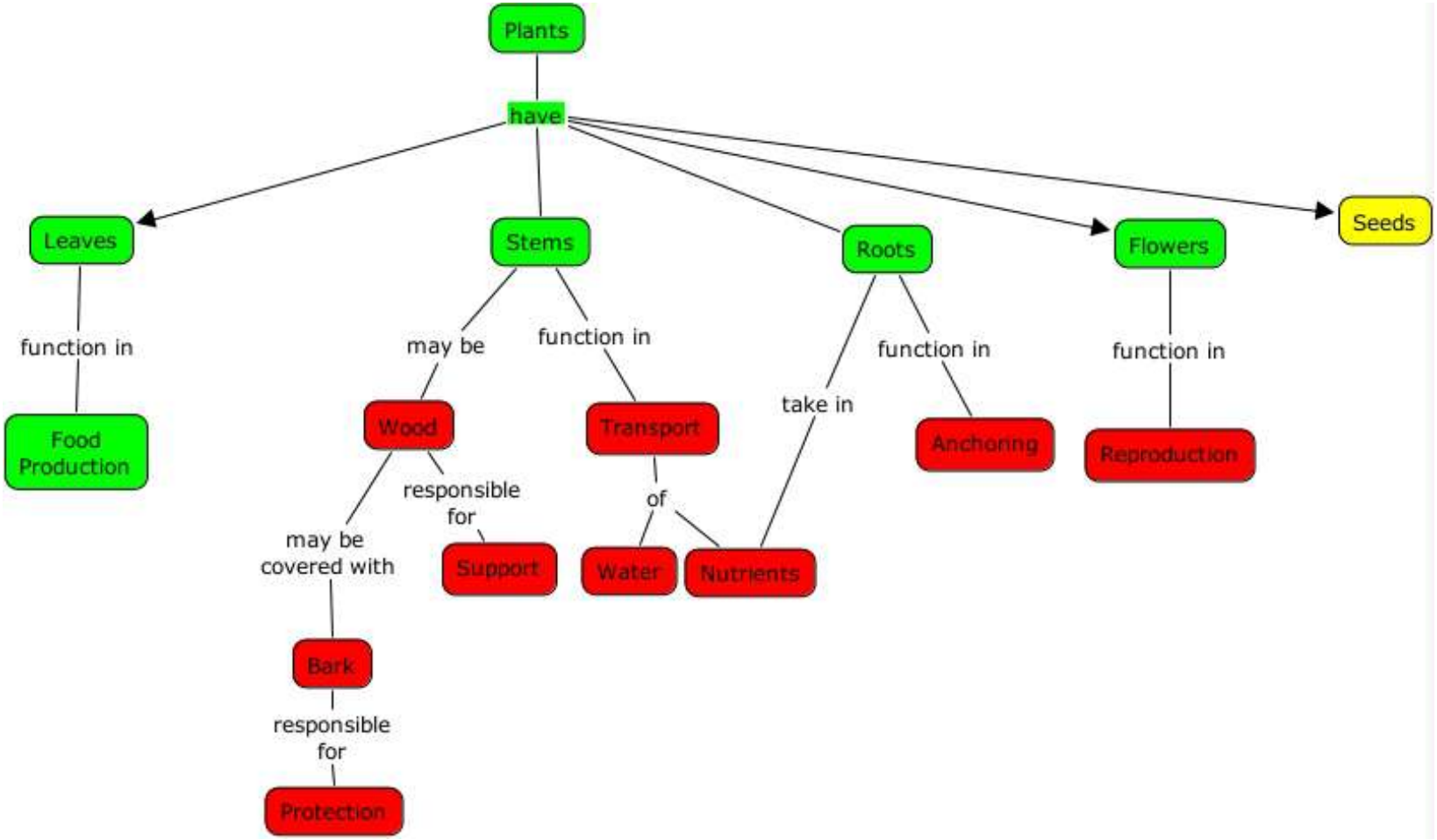
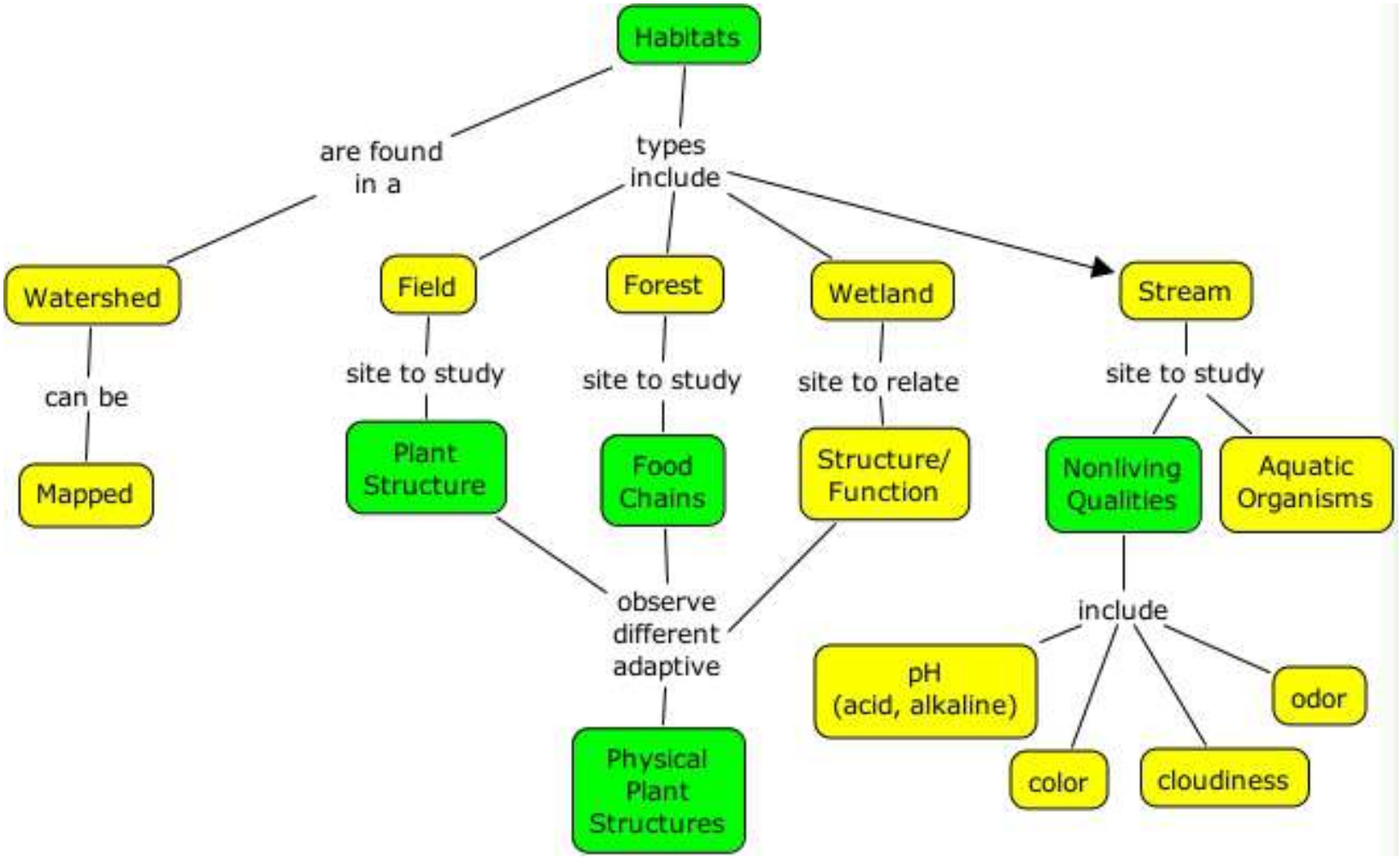

Environment
is interaction of
Nonliving Environment
are interdependent
Living Things
does not have
have
Needs
form
includes
Food Chains
represent
Energy Flow
from
to
Soil
Sunlight
need
Producers
are eaten by
Consumers
Decomposers
made of
Minerals
Organic Humus
can make
Sugar (Food)
through
(Photosynthesis)
at end of life cycle become
e.g.
Fungi
get energy from/ recycle
Dead plants and animals
quality improved by
Earthworms
restore


Plants
have
Leaves
Stems
Roots
Flowers
Seeds
function in
Food Production
may be
function in
Wood
Transport
take in
function in
Anchoring
function in
Reproduction
responsible for
of
may be covered with
Support
Water
Nutrients
Bark
responsible for
Protection


Habitats
are found in a
types include
Watershed
can be
Mapped
Field
site to study
Plant Structure
Forest
site to study
Food Chains
Wetland
site to relate
Structure/ Function
Stream
site to study
Nonliving Qualities
Aquatic Organisms
include
pH (acid, alkaline)
color
cloudiness
odor
observe different adaptive
Physical Plant Structures

Conclusions

- Concepts from state science frameworks can be transformed into template concept maps.
- Color coding concept maps visually clarifies alignment of school content with the frameworks.
- Patterns of areas of alignment indicate areas of nonalignment and extensive areas beyond the framework.
- Connectivity of concept maps indicate where changes can easily be made.

Caveats

- The propositional linkages in standards are not always clearly defined.
- The depth to which a concept is to be understood is not always clear.
- Consequently, interpretation of particular linkages may be subject to question.

Specific Recommendations

- Green concepts are areas of alignment and should be kept.
- Red concepts should be added to the curriculum or clarified if already enacted.
- Yellow concepts indicate areas of strength for the local curriculum and may be considered for addition by the State and/or considered optional by the local system.
- Some categorizations by the State need to be reconceptualized. (e.g. Animal functions should not go under plant headings.)

Recommendations: Alignment

- This analysis could be extended to science process concepts such as questioning, hypothesizing, data collecting, analyzing, concluding, and communicating. Support Atlas work.

- Indicating grade level and sharing with teachers and volunteers would integrate community members to see how their work supports the whole curricular structure. Support SCTS work.

- Apply to interdisciplinary work such as the North American Association for Environmental Education Guidelines for Excellence.

Beyond Alignment

When curriculum clarifies, students can create their own maps as they experience both indoor and outdoor science activities and as they carry out their own scientific experiments using scientific methods. Imagine the growth from K-12 that CmapTools can demonstrate in individual portfolios.

2006: C3M Pilot Work

- CmapTools will be introduced to two high school science classes for students to create their own maps.

- A special needs teacher will use concept mapping strategies with special needs students working in life science and/or earth science.