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ECOLOGICAL OUTCOME VERIFICATION REPORT

HUB

Michigan State University

MASTER/HUB VERIFIER/Monitor

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LANDBASE

Apsey Farm

ECOREGION

Great Lakes Forest

November 2023

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Introduction

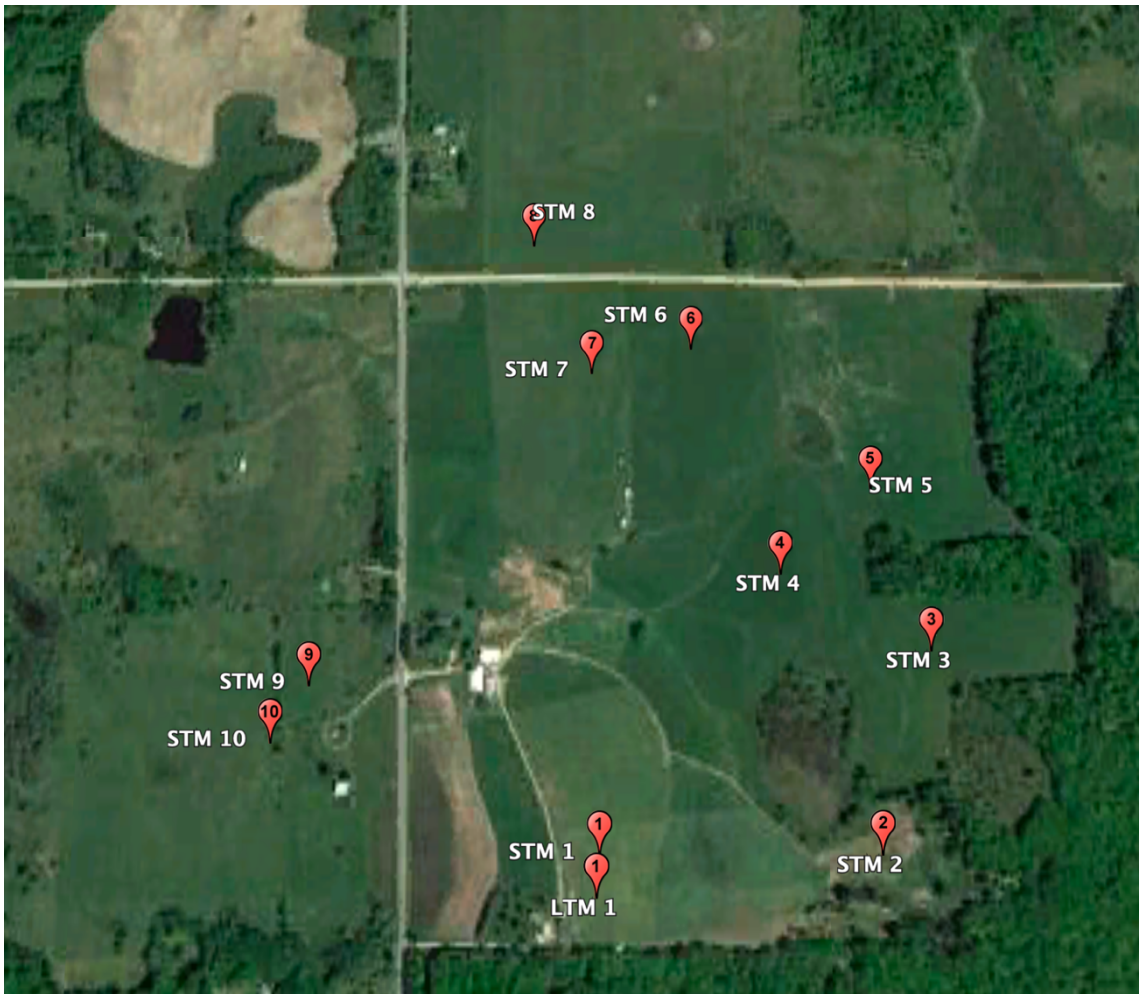
The results of the annual Ecological Outcomes Verification of Apsey Farm, carried out on *June 6, 2023* for Short Term Monitoring, are presented.
The methodology used follows the EOV 3.0 protocol. The ten monitoring sites established in 2019 were evaluated for Evaluation Health Index (EHI). There are two reference areas in the Great Lakes Forest ecoregion. Reference areas are the best-known expression of biodiversity, site stability, and ecosystem function for the desired state in a given ecoregion. The EHI scores for both were down in 2022 primarily due to stricter scoring. Consequently, please take that into consideration when looking at the 2022 scores in this report.

Ecoregion General Overview

Ecoregion	**Great Lakes Forest**
Localization	**Lake City Research Center**
Climate - (TºC : Max/Min - Avg.)	**0.3 to 12.2 with average of 6.25 degrees Celsius**
Rainfall- (mm./ year)	**823/year**
Brittleness Scale	**4**
Main Agricultural Production	**Timber, Livestock, Agronomic crops, mixed fruits and vegetables**

Short Term Monitoring

Apsey Farm with STM and LTM sites



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Forage Evaluation

The forage evaluation was carried out using a visual estimation according to the EOV 3.0 protocol. A total of 10 EHI evaluations and 10 forage evaluation were carried out along the paddocks of Apsey Farms. This estimates the amount of forage available at the time the Short Term Monitoring (STM) was conducted. The following graph shows the estimated forage availability per acre for each paddock. The estimated forage in 2023 was noteworthy as the average was the highest since monitoring was started in 2019 (221% increase over 2019) indicating positive ecological outcomes due to management.

STM Site	Estimated Forage (lbs) 2019	Estimated Forage (lbs) 2021	Estimated Forage (lbs) 2022	Estimated Forage (lbs) 2023
1	1050	1500	2500	3750
2	500	1000	3000	4000
3	1050	2500	1400	3000
4	1050	1000	1300	3600
5	2000	1750	800	4000
6	500	750	1300	2000
7	1500	1250	2000	2500
8	2000	750	800	2250
9	1500	1000	2000	200
10	750	1000	800	1000
Average	1190	1250	1590	2630

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Ecological Health Index

A total of 10 EHI evaluations were conducted in a stratified sample of 10 paddocks of the Research Center. Ecosystem function is assessed through evaluating 14 leading ecological indicators resulting in an Ecological Health Index (EHI) score. For this purpose, the ecological indicators are operationalized in an evaluation matrix that is customized to the relevant ecological region, in this case the Great Lakes Forest ecoregion.
Each indicator receives a score according to the degree of departure from the ecological area potential. The values are added together to obtain a total score at each sampling site. The possible values range from +110 to -120. These ecological indicators are evaluated in the field and then weighted to obtain a value per paddock, and then a weighted average for the farm is calculated. The closer the EHI Value is to 110 is a reflection that ecosystem processes (water cycling, nutrient cycling, energy flow and community dynamics) are moving toward the potential of the site. Lower values (<40), especially negative values, indicate that ecosystem processes are ineffective, and far from the site's potential.

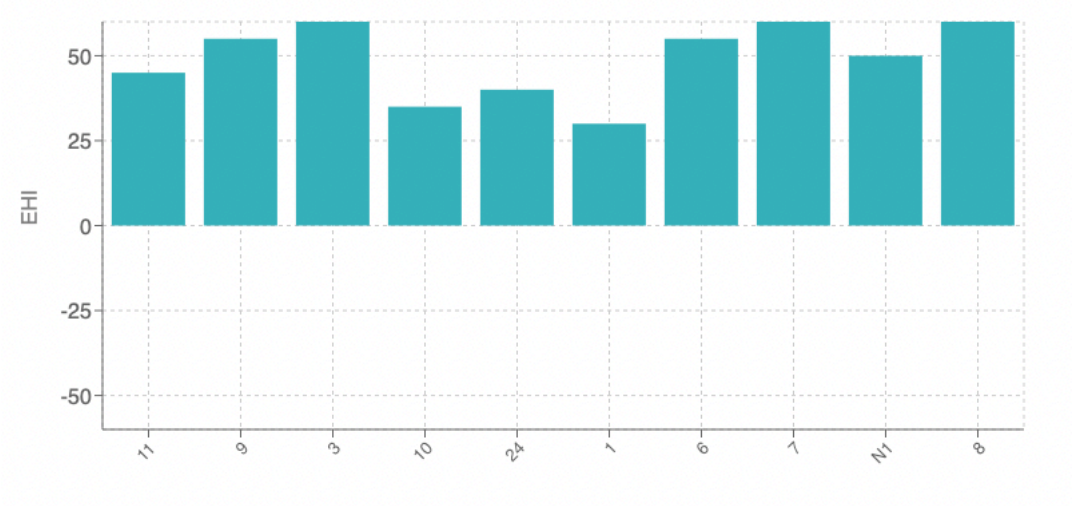
It should be noted that under the EOV 3.0 Protocol it was clarified that if a functional group was not present (e.g. trees and shrubs) then a score of -10 should be assigned. In 2019 scores of 0 were given if the functional group Trees and Shrubs was not present whereas in 2021 a score of -10 was given if the functional group Trees and Shrubs was not present. Therefore, scores going forward (2021 and on) will typically be 10 points lower for a given paddock due to this correction.

Conclusions from Short Term Monitoring

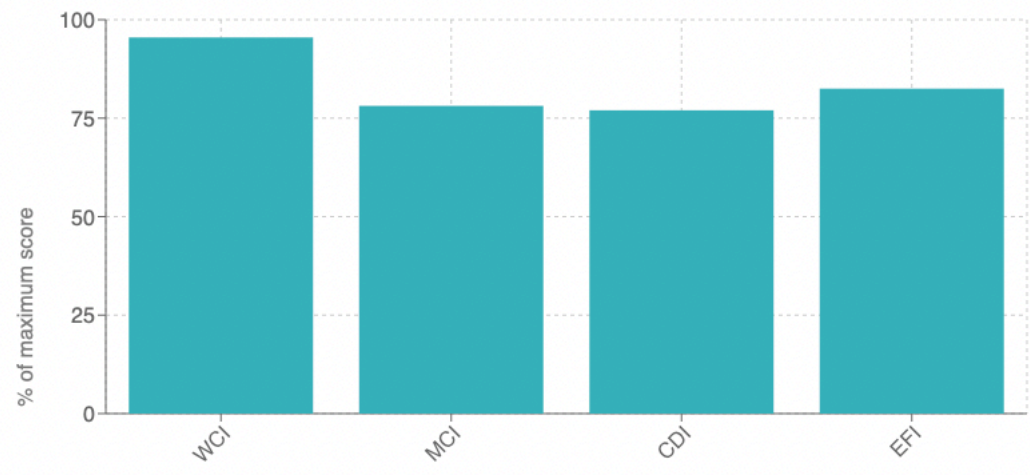
Overall, the scores are good to very good. Management practices that promote plant recovery, litter and a good mineral cycle are the foundation for these scores. The main factor that is causing lower scores are: a) recent grazing reducing live canopy potential and b) lower scores within functional groups due to stricter scoring.

- The Ecological Health Index varied from 30 to 60, with a weighted average of 46.7. This is in comparison to 2022 when the EHI was 35.2.
- The paddock (1) with the lowest score of 30 was due to a recent grazing and lack of vigor for functional groups.
- EHIs allow us to infer that ecosystem processes of water cycle, nutrient cycle, energy flow and community dynamics are all functioning well. All indices have improved or remained stable except community dynamics.
    - Energy flow had an index 82.5. While this is a good score, it is an area that can be improved upon with a focus on improving live canopy area.
    - Water cycle had an index of 95.5 indicating a well-functioning water cycle.
    - The mineral cycle had an index of 78.1 also indicating a well-functioning mineral cycle.
    - Community dynamics is primarily a measure of the health of functional groups (vegetative vigor, reproductive and crown integrity). Community dynamics had an index of 77. This has decreased from 2019 however this can be attributed to a stricter scoring protocol for functional groups.
- Overall, the paddocks looked in the best shape we have seen since we begin monitoring in 2019.
- Based on these results we will be requesting Savory EOV Quality Assurance to issue a EOV Verification Certificate for Apsey Farms.

EHI By Pasture



Ecosystem Function Indexes



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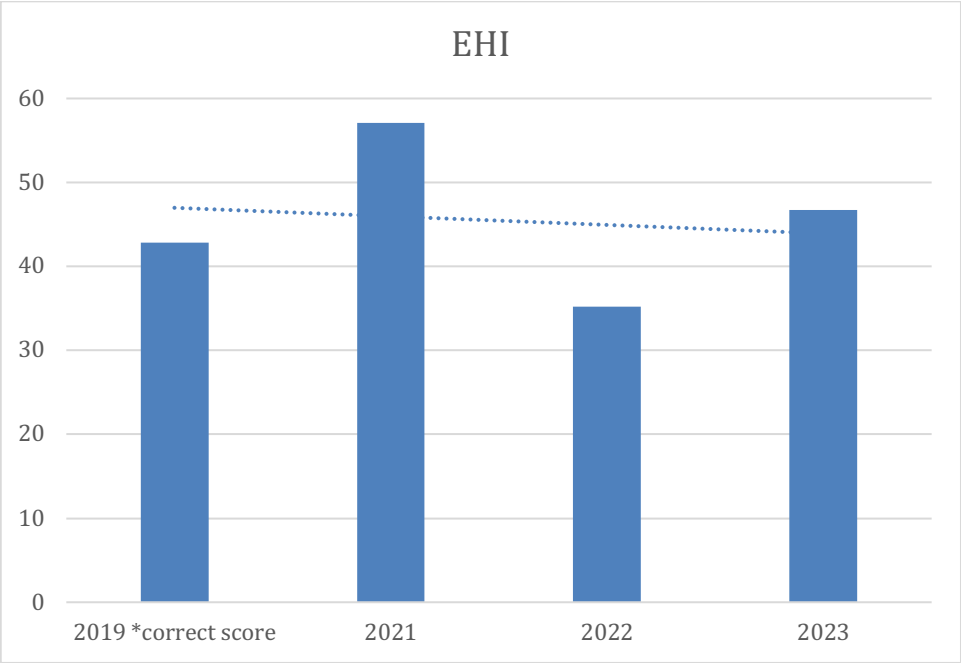
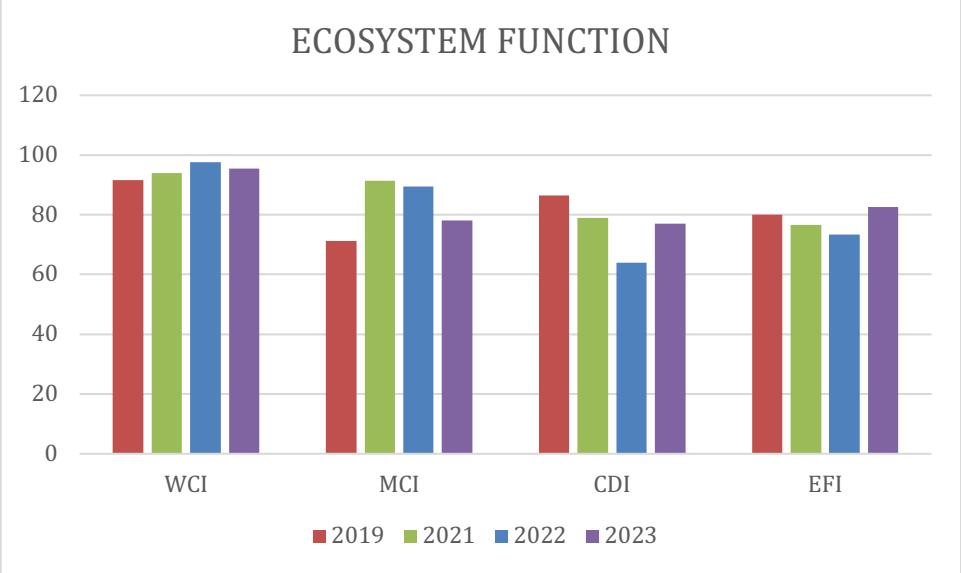
Trends





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Short Term Monitoring Photos

STM site 1 – (3) High score of 60

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STM site 1- (3) High score of 60

STM site 9- (1) Low score of 30

STM site 9- (1) Low Score of 30

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Appendix

Summaries from Previous Years

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2022 Data

Conclusions from Short Term Monitoring

Overall, the scores are good to very good. Management practices that promote plant recovery, litter and a good mineral cycle are the foundation for these scores. The main factor that is causing lower scores are: a) recent grazing reducing live canopy potential and b) lower scores within functional groups due to stricter scoring.

- The Ecological Health Index varied from 20 to 55, with a weighted average of 35.2. This is in comparison to 2021 when the EHI was 57.1 and 52.8 in 2019. However, the drop in 2022 can be attributed to stricter scoring protocol. These factors can be seen in lower live canopy area and functional group scores.
- The paddock (24) with the lowest score of 20 was due to a recent grazing and lack of litter.
- EHIs allow us to infer that ecosystem processes of water cycle, nutrient cycle, energy flow and community dynamics are all functioning well. All indices have improved or remained stable except community dynamics.
    - Energy flow had an index 73.3. While this is a good score, it is an area that can be improved upon with a focus on improving live canopy area.
    - Water cycle had an index of 97.5 indicating a well-functioning water cycle.
    - The mineral cycle had an index of 89.4 also indicating a well-functioning mineral cycle.
    - Community dynamics is primarily a measure of the health of functional groups (vegetative vigor, reproductive and crown integrity). Community dynamics had an index of 73.3. This has decreased from 2019 however this can be attributed to a stricter scoring protocol for functional groups.
- Overall, the paddocks looked in the best shape we have seen since we begin monitoring in 2019.
- Based on these results we will be requesting Savory EOV Quality Assurance to issue a EOV Verification Certificate for Apsey Farms.

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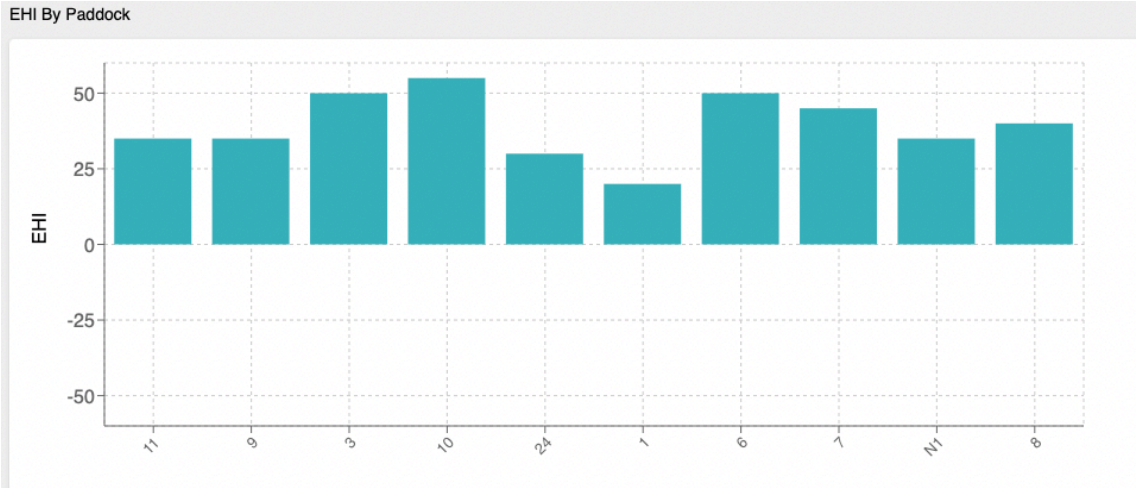
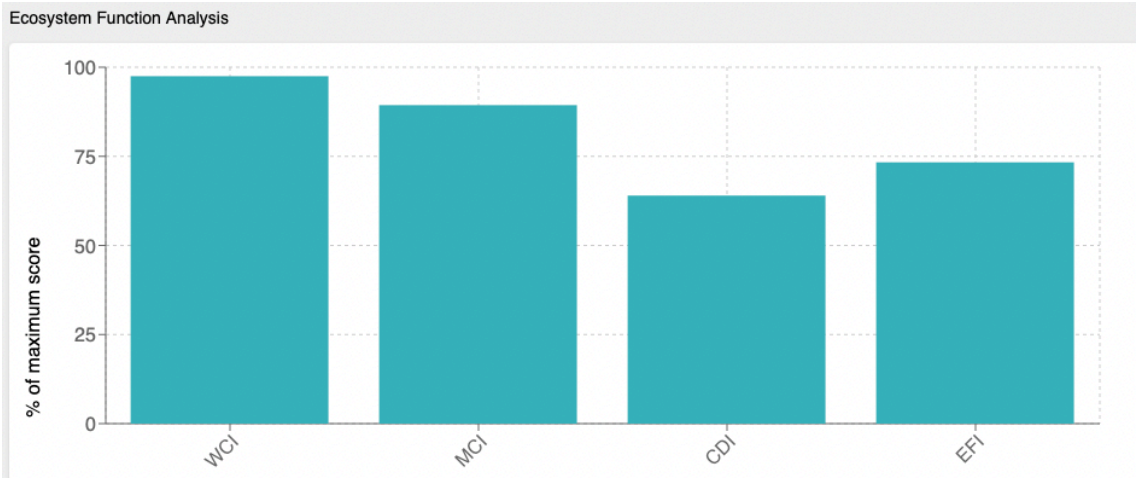
EHI By Pasture



Ecosystem Function Indexes



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Short Term Monitoring Photos

STM site 6 – (10) High score of 55

STM site 6- (10) High score of 55

STM site 10- (24) Low score of 20

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STM site 10- (24) Low Score of 20

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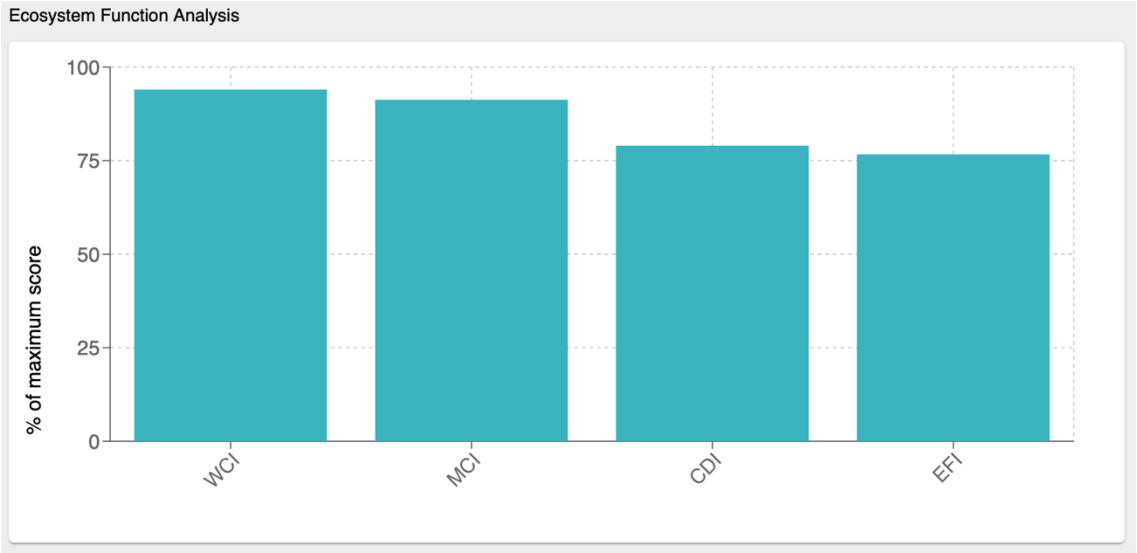
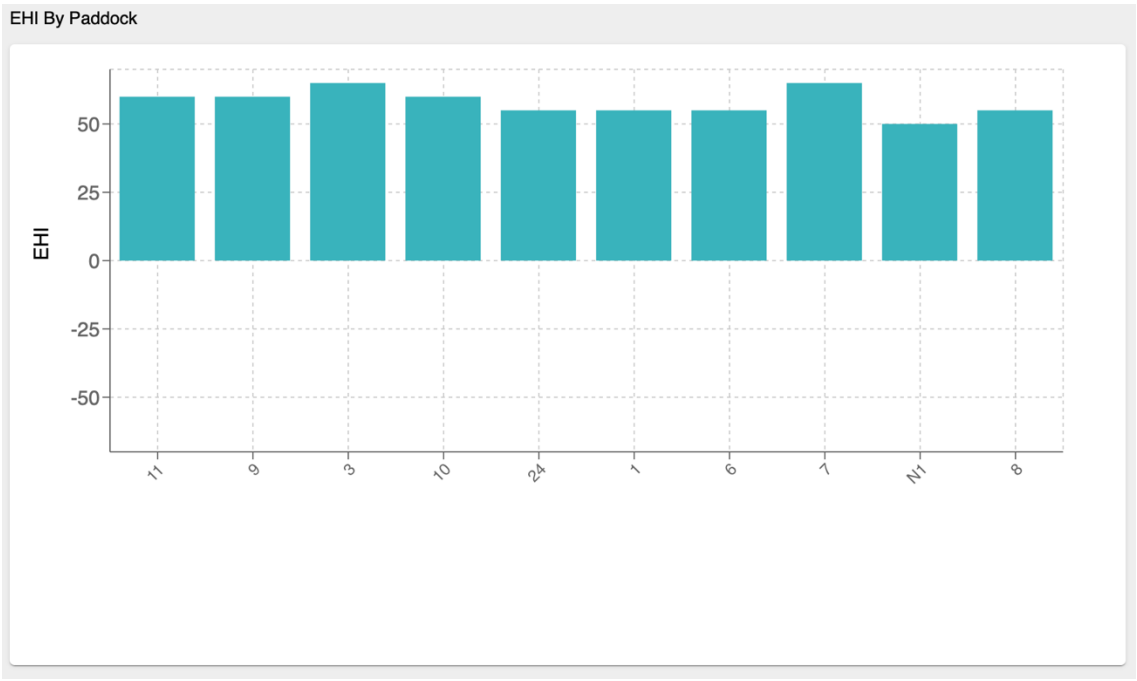
2021 Data

EHI LANDSCAPE FUNCTION ANALYSIS





Conclusions from Short Term Monitoring

Overall, the scores are very good to excellent. Management practices that promote plant recovery, litter and minimal bare ground are the foundation for these scores. The main factors that are causing lower scores are: a) recent grazing reducing live canopy potential and b) lack of litter.

- The Ecological Health Index varied from 50 to 65, with a weighted average of 57.1. This is in comparison to 2019 when the EHI was 52.8. Therefore, despite the correction of the missing functional group of Trees/Shrubs the EHI improved.
- The paddock with the lowest score of 50 was due to lack of live canopy after a recent hay cutting.
- EHIs allow us to infer that ecosystem processes of water cycle, nutrient cycle, energy flow and community dynamics are all functioning well.
    - Energy flow had an index 76.7. While this is a good score, it is an area that can be improved upon with a focus on improving live canopy area.
    - Water cycle had an index of 94 indicating a well-functioning water cycle.
    - The mineral cycle had an index of 91.3 also indicating a well-functioning mineral cycle.
    - Community dynamics had an index of 79 indicating a diversity of vegetative species along with above and below ground organisms.
- Based on these results we will be requesting Savory EOV Quality Assurance to issue a EOV Verification Certificate for Apsey Farms.

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STM PHOTOS

STM site 1- 3 High score of 65

STM site 1- 3 High score of 65

STM site 8- N1 Low score of 50

STM site 8- N1 Low Score of 50

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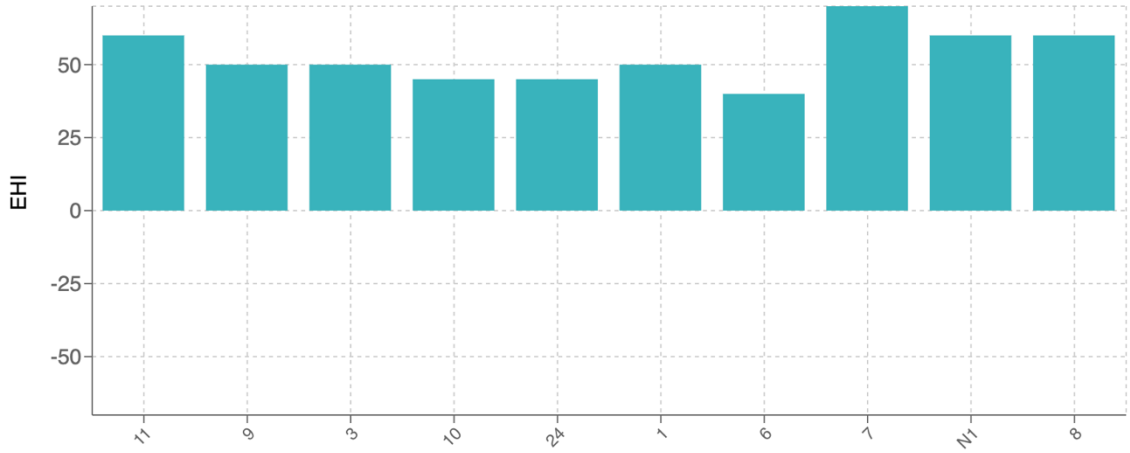
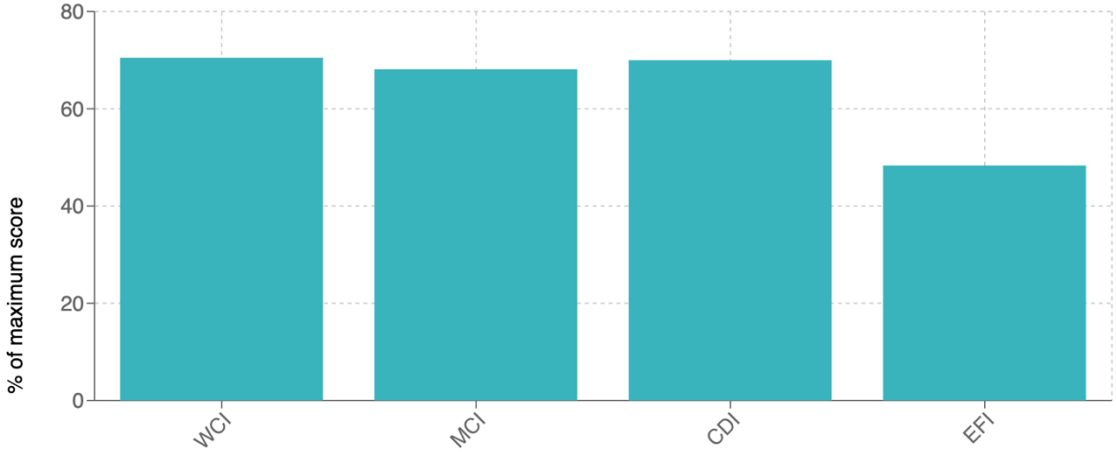
2019 Data

EHI By Paddock

LANDSCAPE FUNCTION ANALYSIS



LANDSCAPE FUNCTION ANALYSIS



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Conclusions from Short Term Monitoring

Overall the scores are excellent. Management practices that promote litter, minimal bare ground, and live canopy index are the foundation for these scores. The main factor that caused a lower score was probably due to the paddock being recently grazed.

- The Ecological Health Index varied from 45 to 70, with an average of 52.8
- There was one paddock (10) with a lower score of 45 which is still a very good score. This was probably due to a recent grazing event.
- EHIs allow us to infer that ecosystem processes of water cycle, nutrient cycle, energy flow and community dynamics are all functioning well.
    - Energy flow had an index 48.3 indicating a good functioning energy flow. This can be improved by continuing to focus on increasing live canopy index.
    - Water cycle had an index of 70.5 indicating a well-functioning water cycle
    - The mineral cycle had an index of 68 also indicating a well-functioning mineral cycle
    - Community dynamics had an index of 70 indicating a diversity of vegetative species along with above and below ground organisms.

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STM PHOTOS

STM site 6 – 10 Low score of 45

STM site 6- 10 Low score of 45

STM site 4- 7 High score of 70

STM site 4- 7 score of 70