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Integrating Duckweed into a Chain Brine Users: Enhancing the value of Desalination Byproducts

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Desalination brine is increasingly recognized as a potential resource rather than a waste stream requiring disposal. This study presents a modelling strategy for sequentially reusing desalination concentrate for food production, fish culture (food) and irrigation of salt-tolerant halophytes crops, including *Atriplex lentiformis* and *Salicornia bigelovii*. The proposed system follows a serial structure in which brine is progressively utilized through duckweed cultivation, fish production, and halophyte irrigation. The halophyte component is particularly relevant to the Ramat Negev region, where groundwater salinity is approximately 4.4 dS/m, demonstrating the feasibility of saline-water agriculture under local conditions. *S. bigelovii* plant is emphasized because of its high productivity, nutritional value, livestock acceptability, and broad salinity tolerance. For a small reverse-osmosis plant processing $50 \text{ m}^3 \text{ d}^{-1}$ and generating $27 \text{ m}^3 \text{ d}^{-1}$ of concentrate with an electrical conductivity of 20.3 mS/cm, the model estimates that 0.36 ha of cultivated land would be required to utilize the entire concentrate stream. The system could produce approximately 10.3 metric tons of forage annually, potentially supporting 37 goats or sheep, 11 camels, or 5 cattle. Although the estimated crop value is modest (approximately €467/(ha*yr), the principal benefit is resource recovery: converting desalination brine into livestock feed while reducing concentrate disposal. The approach is scalable according to brine availability, land resources, and livestock demand.

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References

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