Participatory development of surface model (Ankita Yadav)

Participatory Understanding of Groundwater Dynamics: Threats and Responsive Management (الهند)

CDVI 3D Model

الوصف

CoDriVE-VI is a participatory approach that integrates local knowledge with scientific data through 3D visual modelling to assess groundwater vulnerability and support sustainable, community-based groundwater management. It overlays surface and subsurface features, enabling villagers to visualize aquifer systems and develop informed water use plans.

CoDriVE-VI (Community-driven Vulnerability Evaluation – Visual Integrator) is a participatory approach developed by the Watershed Organisation Trust (WOTR) to support sustainable groundwater management. It aims to demystify the invisible subsurface and make aquifer systems understandable to rural communities by combining scientific tools with local knowledge in a hands-on, visual format. While the process is facilitated by WOTR, communities are placed at the center of the process, contributing traditional insights, assisting with data collection, and actively participating in constructing and interpreting the 3D model. Thus, the approach is best described as participatory, with strong elements of community ownership and engagement.

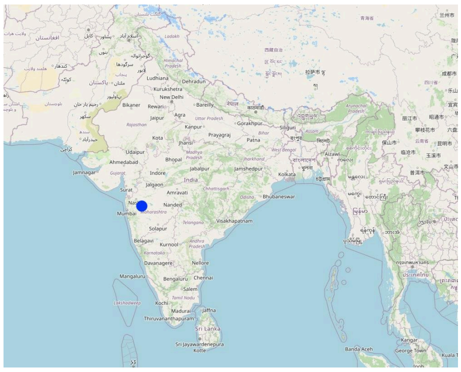
The "Visual Integrator" refers to the integration of both surface and subsurface data—such as topography, drainage, geology, well inventory details, and geophysical survey results—into a tangible, scaled three-dimensional model. This participatory 3D modelling (P3DM) process helps communities visualize how aquifers relate to the landscape, showing key features such as recharge zones, discharge points, and areas of intensive groundwater extraction.

"Vulnerability evaluation" is carried out through the community's participatory analysis of the model. Using the integrated visual platform, villagers can identify zones that are more vulnerable to depletion—such as those with low recharge, high borewell density, or historically declining water tables. While a formal vulnerability matrix is not used, the 3D model serves as a practical vulnerability map. It guides discussions and decisions around water budgeting, aquifer recharge, crop-water planning, and the development of informal rules for responsible groundwater use.

The methodology combines participatory rural appraisal with hydrogeological and geospatial techniques. After an initial orientation and trust-building phase, communities help map surface features. Subsurface data is then collected through geological mapping, well inventory surveys, and geophysical methods like Vertical Electrical Sounding (VES). The data are analyzed using GIS tools and inverse slope modelling. The 3D model is then constructed using layered cardboard sheets, with communities contributing throughout the process—cutting, assembling, painting, and validating the layers.

The CoDriVE-VI process unfolds in several stages: community mobilization and planning; surface and subsurface data collection; model building in participatory workshops; and result interpretation and management planning. Key stakeholders include community members, WOTR facilitators, technical experts (geologists and GIS specialists), and local governance

الموقع



الموقع: Darewadi,Post. Kauthe Malkapur Tal. Sangamner, Dist. Ahilyanagar, Maharashtra, Maharashtra, الهند

المرجع الجغرافي للمواقع المختارة

- 74.33319, 19.41036

تاريخ البدء: 2017

سنة الإنهاء: غير متاح

نوع النهج

- تقليدي/أصلي
- مبادرة محلية حديثة/مبتكرة
- قائم على مشروع/برنامج

representatives.
Participants found the visual models highly effective in helping them grasp aquifer dynamics, leading to a shift in perception—from seeing groundwater as an individual entitlement to recognizing it as a shared resource. This in turn fostered collective decision-making. The approach has also contributed to improved groundwater literacy, informed water budgeting, and motivated some villages to initiate local groundwater governance practices.
While climate change is a key driver of groundwater stress, the approach also acknowledges other socio-economic and environmental pressures—such as population growth, land-use change, deforestation, and the uncontrolled proliferation of borewells—as critical factors influencing groundwater vulnerability. By visualizing these interconnections, CoDriVE-VI supports more holistic and sustainable groundwater management at the community level.

Surface and subsurface models of CoDriVE (Navnath Ghodake)

interaction with Community (Ankita Yadav)

غايات النهج والبيئة المواتية

الغايات/الأهداف الرئيسية للنهج
1. To build the capacity of rural communities to understand groundwater systems, including aquifer behavior and climate and non-climate stressors affecting groundwater availability.

2. To make subsurface aquifer characteristics visible and comprehensible through participatory 3D modelling that integrates scientific and local knowledge.

3. To foster collective ownership and sustainable management of groundwater as a shared, finite resource.

4. To support community-led evaluation of groundwater vulnerability and guide responsive actions such as water budgeting and recharge planning.

5. To document, preserve, and apply indigenous spatial knowledge related to land use, topography, and local water systems.

6. To enable informed decision-making by facilitating the transfer of community-generated insights to local governance bodies and development agencies.

الشروط التي تمكن من تنفيذ التقنية/التقنيات المطبقة في إطار النهج
- **المعايير والقيم الاجتماعية /الثقافية/ الدينية**: The participatory nature of CoDriVE aligns well with community-based traditions and values. Villagers appreciated visual models and collective dialogue.
- **الإطار المؤسساتي**: Support from institutions like WOTR and local governance structures helped facilitate workshops and technical assessments.
- **التعاون/التنسيق بين الجهات الفاعلة**: Strong collaboration between communities, facilitators, technical experts, and local leaders enabled smooth implementation
- **السياسات**: National and state-level programs like Atal Bhujal Yojana and Maharashtra Groundwater Act 2009 support aquifer-based planning and groundwater literacy.
- **حوكمة الأراضي (صنع القرار والتنفيذ والإنفاذ)**: Local institutions and village-level bodies were engaged in discussions and planning.
- **المعرفة حول الإدارة المستدامة للأراضي، والوصول إلى الدعم الفني**: Technical support from WOTR and use of local knowledge supported learning and capacity building
- **عبء العمل، توفر القوى العاملة**: Community enthusiasm and involvement were high during workshops and model building.
- **غير ذلك**: Visual and tactile tools helped bridge the knowledge gap between experts and villagers.

الظروف التي تعيق تنفيذ التقنية/التقنيات المطبقة في إطار النهج
- **توفر/الوصول إلى الموارد والخدمات المالية**: Physical model preparation and technical surveys (like geophysical VES) require resources. Financial constraints can limit replication or scaling.

- **الإطار القانوني (حيازة الأراضي، وحقوق استخدام الأراضي والمياه)**: Customary laws viewing groundwater as private property can hinder the recognition of aquifers as shared resources.
- **عبء العمل، توفر القوى العاملة**: Manual preparation of 3D models requires time and coordination, which may be demanding in some villages.
- **غير ذلك**: Initial complexity of scientific terms (e.g., aquifer, resistivity) required careful facilitation and adaptation

مشاركة وأدوار الأطراف المعنية

الأطراف المعنية بالنهج وأدوارها

ما هي الجهات المعنية / الكيانات المنفذة التي شاركت في النهج؟	حدد الأطراف المعنيين	وصف أدوار الأطراف المعنية
مستخدمو الأراضي المحليون/المجتمعات المحلية	Villagers and farmers from Ahilyanagar and Jalna districts, Maharashtra	They participated actively in the mapping exercises, provided indigenous knowledge on topography and land use, contributed to well inventory and aquifer-related insights, and were directly involved in building the 3D models. Their engagement was central in interpreting subsurface information and applying it to groundwater planning.
المنظمات المجتمعية	Village Water Management Committees, Water Stewardship groups	Helped mobilize community members, facilitated communication between villagers and technical teams, and supported local-level planning and rule-setting for groundwater use.
متخصصون ي الإدارة المستدامة للأراضي / مستشارون زراعيون	WOTR technical staff and hydrogeology facilitators	Provided scientific inputs on geology and hydrogeology, conducted well and geophysical surveys, interpreted data, supported the construction of groundwater potential maps, and trained community members in groundwater management
الباحثون	Researchers and field investigators from WOTR and contributing institutions	Developed the methodology, documented experiences, synthesised scientific and community knowledge, and analysed feedback for continuous improvement of the tool.
منظمة غير حكومية	Watershed Organisation Trust (WOTR)	Lead agency responsible for conceptualizing, facilitating, implementing, and documenting the approach. Conducted workshops, managed technical assessments, trained field teams, and engaged communities.
القطاع الخاص	HSBC Software Development India (as supporter)	Provided financial support for printing and disseminating the CoDriVE-VI manual.
الحكومة المحلية	Gram Panchayat members, Sarpanches	Participated in workshops, helped validate maps and data, encouraged community participation, and supported local rule-making for sustainable groundwater use.
الحكومة الوطنية (المخططون، صانعو القرار)	Indirectly linked via supportive policies (e.g., Atal Bhujal Yojana, National Aquifer Management Project (NAQUIM))	Although not directly involved in implementation, national policies provided support for the overall context and justification of aquifer-based participatory planning and water budgeting.
منظمة دولية	ProSoil project (GIZ)	Supported in publishing and promoting the CoDriVE-VI manual, including showcasing it at UNCCD COP14

الوكالة الرائدة
Watershed Organisation Trust (WOTR)

انخراط مستخدمي الأراضي المحليين/المجتمعات المحلية في المراحل المختلفة للنهج

	غير موجود	سلبي	الدعم الخارجي	تفاعلي	التعبئة الذاتية	
المبادرة/التحفيز				✓		Local villagers in the project areas (e.g., Ahilyanagar and Jalna districts) were engaged early through orientation sessions. While the initiative was introduced by WOTR, community members showed interest and contributed knowledge from the beginning, especially around their water challenges and local hydrogeology.
التخطيط				✓		Villagers participated in identifying key features for surface mapping, shared traditional knowledge of aquifers and land use, and were involved in selecting locations for surveys. Their inputs shaped both the design and scale of the models.
التنفيذ				✓		Community members took part in well inventory surveys, guided geological observations, and actively built the 3D physical models. They also helped colour-code aquifer zones under facilitators' guidance, and validated the data presented.
الرصد/التقييم				✓		During workshops and feedback sessions, villagers evaluated the accuracy of models, reflected on the implications of subsurface characteristics, and discussed how to use the insights for water budgeting and community planning

مخطط التدفق

The visual summary illustrates the four key stages of the CoDriVE-VI approach

Initiation
-Stakeholder meetings and community orientation sessions are conducted.
-Local water-related challenges are identified.
-Builds a foundation for participatory engagement and problem recognition.

Planning

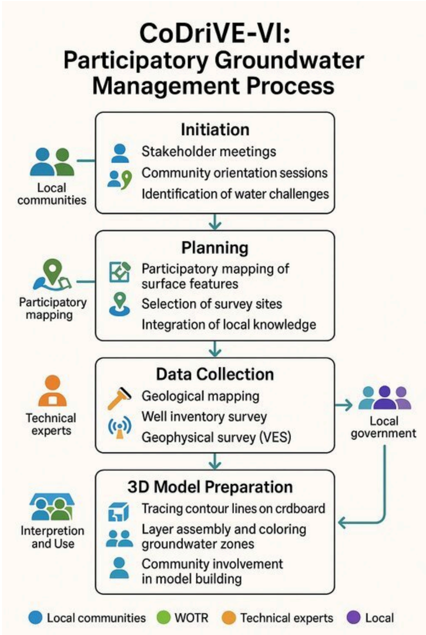
-Participatory mapping of surface features is carried out.
-Survey sites are selected based on local inputs and technical feasibility.
-Local knowledge is integrated with scientific planning.

Data Collection

-Technical experts conduct geological mapping and well inventory surveys.
- Geophysical surveys (e.g., Vertical Electrical Sounding - VES) are performed.
- Scientific data on groundwater systems is gathered for model development.

3D Model Preparation

-Contour lines are traced on cardboard to build physical models.
-Groundwater zones are assembled and color-coded.
-Communities are actively involved in model building and interpretation for better understanding and use.



المؤلف: Pratik Ramteke

اتخاذ القرار بشأن اختيار تقنية الإدارة المستدامة للأراضي

وقد تم اتخاذ القرارات من قبل
- ☐ مستخدمو الأراضي وحدهم (المبادرة الذاتية)
- ☐ مستخدمو الأراضي بشكل أساسي، بدعم من متخصصي الإدارة المستدامة للأراضي
- ☑ جميع الجهات الفاعلة ذات الصلة، كجزء من نهج تشاركي
- ☐ متخصصون في الإدارة المستدامة للأراضي بشكل أساسي، بعد التشاور مع مستخدمي الأراضي
- ☐ متخصصون في الإدارة المستدامة للأراضي بمفردهم
- ☐ السياسيون / القادة

تم اتخاذ القرارات بناء على
- ☑ تقييم المعرفة الموثقة جيدًا بشأن الإدارة المستدامة للأراضي(اتخاذ القرارات القائمة على الأدلة)
- ☑ نتائج البحوث
- ☑ خبرة وآراء شخصية(غير موثقة)
- ☑ Decisions were based on field experiences from over 25 villages, scientific methods (e.g., VES surveys, GIS analysis), and documented evidence on aquifer-based planning. Local knowledge and experiential insights also guided model design and validation.

الدعم الفني وبناء القدرات وإدارة المعرفة

شكلت الأنشطة أو الخدمات التالية جزءًا من النهج
- ☑ بناء القدرات/التدريب
- ☑ خدمة استشارية
- ☑ تعزيز المؤسسات (التطوير التنظيمي)
- ☑ الرصد والتقييم
- ☑ البحوث

بناء القدرات/التدريب

تم تقديم التدريب للأطراف المعنية التالية
- ☑ مستخدمو الأراضي
- ☑ موظفون ميدانيون/ مستشارون

شكل التدريب
- ☑ في العمل
- ☑ من مزارع إلى مزارع
- ☑ مناطق العرض
- ☑ اجتماعات عامة
- ☐ دورات

المواضيع المغطاة

•Basic concepts of hydrogeology and aquifers
•Groundwater vulnerability and common pool resource concepts
•Surface and subsurface mapping
•Use of Participatory 3D Modelling (P3DM)
•Groundwater budgeting
•Climate change impacts on water resources
•Community-led planning and rule-setting for water use

خدمة استشارية

تم تقديم الخدمة الاستشارية
- ☑ في حقول مستخدمي الأراضي
- ☑ في مراكز دائمة

WOTR provided technical assistance through facilitators and hydrogeology experts. These acted as advisors, guiding communities in surveys, model interpretation, and decision-making.

تعزيز المؤسسات

تم تعزيز/إنشاء المؤسسات
- ☐ لا
- ☐ نعم، قليلا
- ☑ نعم، باعتدال
- ☐ نعم، إلى حد كبير

على المستوى التالي
- ☑ محلي
- ☐ إقليمي
- ☐ وطني

صف المؤسسة والأدوار والمسؤوليات والأعضاء وما إلى ذلك.

Village Water User Groups (VWUGs) and local governance committees were strengthened to coordinate groundwater management activities. Their roles included planning water use, monitoring aquifer health, implementing community water rules, and facilitating knowledge sharing. Members typically included local farmers, community leaders, and field facilitators

نوع الدعم
- ☐ مالي
- ☑ بناء القدرات/التدريب
- ☑ معدات

مزيد من التفاصيل

The strengthening focused on enhancing institutional capacity to support community-driven water resource management. Training sessions improved leadership and technical skills, enabling institutions to take ownership of groundwater sustainability. Equipment such as GPS units and simple monitoring devices were provided to aid local data collection and verification.

الرصد والتقييم

Monitoring was integrated through periodic community workshops, feedback sessions, and participatory verification of groundwater models. Evaluation focused on assessing the accuracy of aquifer mapping, effectiveness of capacity building, and impact on local water management practices.

البحوث

تناول البحث المواضيع التالية
- ☑ علم الاجتماع
- ☐ الاقتصاد / التسويق
- ☑ علم الايكولوجيا
- ☑ تكنولوجيا
- ☑ Hydrogeology and participatory modelling

Research was integral to developing and refining the CoDriVE methodology. Hydrogeologists and social scientists collaborated with local communities to understand groundwater systems and social dynamics influencing water use. Technology research focused on participatory 3D modeling tools and groundwater budgeting techniques. WOTR staff, partnered with academic institutions and experts in hydrogeology, led the research activities. Community feedback was also systematically documented to improve approaches.

التمويل والدعم المادي الخارجي

الميزانية السنوية بالدولار الأمريكي لمكون الإدارة المستدامة للأراضي
- ☐ < 2000
- ☐ 10,0000-2,000
- ☑ 100,000-10,000
- ☐ 1,000000-100,000
- ☐ > 1,000,000

Precise annual budget: غير متاح

Funding mainly came from government development programs and international donor agencies supporting WOTR's groundwater management initiatives. Major donors included state water departments and NGOs focused on sustainable water use.

تم تقديم الخدمات أو الحوافز التالية لمستخدمي الأراضي
- ☑ الدعم المالي/المادي المقدم لمستخدمي الأراضي
- ☑ إعانات لمدخلات محددة
- ☐ الائتمان
- ☑ حوافز أو وسائل أخرى

الدعم المالي/المادي المقدم لمستخدمي الأراضي

Material support included provision of tools and equipment such as GPS devices and monitoring kits, provided free or at subsidized cost by project partners. Some minor financial incentives were given as stipends during training sessions. Support was conditional on active participation in capacity-building and water management activities. Providers included WOTR and partner NGOs.

	ممول جزئيا	ممول بالكامل
عمالة	☑	☐

Labour costs for technical support and community mobilization were partly supported by the implementing agency or development partners

العمل من قبل مستخدمي الأراضي كان

- [x] تطوعي
- [ ] الغذاء مقابل العمل
- [ ] مدفوع نقدا
- [ ] مقابل دعم مادي آخر

حوافز أو وسائل أخرى

Supportive policies included local water governance regulations encouraging sustainable groundwater use and community rule enforcement. NGO advocacy helped secure government backing for participatory water management.

تحليل الأثر والتصريحات الختامية

آثار النهج

	لا	نعم، قليلا	نعم، باعتدال	نعم، إلى حد كبير
هل ساهم النهج في تمكين مستخدمي الأراضي المحليين وتحسين مشاركة الأطراف المعنية؟ The participatory 3D modelling process directly involved villagers in mapping and decision-making. It created a sense of shared ownership over groundwater resources, enabling community-level rule-making and active participation in groundwater governance				✓
هل مكّن النهج من اتخاذ القرارات المبنية على الأدلة؟ Scientific tools such as geophysical surveys, geological mapping, and GIS-based groundwater potential maps enabled villagers to base water management decisions on accurate data integrated with traditional knowledge				✓
هل ساعد النهج مستخدمي الأراضي على تنفيذ وصيانة تقنيات الإدارة المستدامة للأراضي؟ By making aquifer dynamics visible, the approach supported sustainable agricultural planning and water budgeting, which are part of SLM practices, although it focused more on literacy and awareness than direct technology implementation			✓	
هل نجح النهج في تحسين التنسيق والتنفيذ الفعال من حيث التكلفة لأنشطة الإدارة المستدامة للأراضي؟ It fostered collaboration among community members, local institutions, and technical experts, creating alignment in groundwater-related decisions.			✓	
هل نجح النهج في تعبئة/تحسين الوصول إلى الموارد المالية لتنفيذ الإدارة المستدامة للأراضي؟ The approach was low-cost and supported by NGOs and donor funding.	✓			
هل أدى النهج إلى تحسين معرفة وقدرات مستخدمي الأراضي على تنفيذ الإدارة المستدامة للأراضي؟ The process enhanced groundwater literacy, built capacity for aquifer-based planning, and enabled villagers to understand recharge/discharge zones and water budgeting.				✓
هل أدى النهج إلى تحسين معرفة وقدرات الأطراف المعنية الأخرى؟ Local government representatives and NGO facilitators gained insights into how to communicate complex hydrogeological data using participatory tools, enhancing their capacity to support SLM.			✓	
هل ساهم النهج في بناء/تعزيز المؤسسات والتعاون بين الأطراف المعنية؟ Village Water Committees and informal community groups were strengthened through workshops, joint planning, and shared understanding of groundwater resources			✓	
هل ساهم النهج في التخفيف من حدة الصراعات؟ By visualizing the shared nature of groundwater resources, it reduced the perception of groundwater as private property and encouraged collective action, which can mitigate user-level conflicts.			✓	
هل ساهم النهج في تمكين الفئات المحرومة اجتماعيا واقتصاديا؟ The approach was inclusive and community-wide. Women’s participation was specifically encouraged, though economic empowerment was not a primary focus.			✓	
هل أدى النهج إلى تحسين المساواة بين الجنسين وتمكين النساء والفتيات؟ Women were involved in workshops and discussions, recognizing their central role in water use.		✓		
هل شجع النهج الشباب/الجيل القادم من مستخدمي الأراضي على الانخراط في الإدارة المستدامة للأراضي؟ The participatory and educational nature of the tool could be adapted for such use.		✓		
هل أدى النهج إلى تحسن في مسائل حيازة الأراضي / حقوق المستخدمين التي أعاقت تنفيذ تقنيات الإدارة المستدامة للأراضي؟ The approach challenged the perception of groundwater as an individual property, promoting a common-pool perspective.		✓		
هل أدى هذا النهج إلى تحسين الأمن الغذائي / تحسين التغذية؟ While not directly linked, improved water planning and sustainable groundwater use could contribute indirectly to more reliable irrigation and reduced crop failure.		✓		
هل أدى النهج إلى تحسين الوصول إلى الأسواق؟	✓			
هل أدى النهج إلى تحسين الوصول إلى المياه والصرف الصحي؟			✓	

By improving groundwater management and awareness, the approach contributed to more sustainable access to water for drinking and agriculture.

هل أدى النهج إلى استخدام طاقة/ مصادر طاقة أكثر استدامة؟ ☑ ☐ ☐ ☐

هل أدى النهج إلى تحسين قدرة مستخدمي الأراضي على التكيف مع التغيرات المناخية/الظواهر المناخية المتطرفة والتخفيف من الكوارث المرتبطة بالمناخ؟ ☐ ☐ ☐ ☑

The tool helped communities understand climate variability's impact on aquifers, supported water risk assessment, and promoted resilience through informed water use planning.

هل أدى النهج إلى توفير فرص عمل ودخل؟ ☐ ☑ ☐ ☐

Indirect employment through training, facilitation, and workshops was possible.

المحفز الرئيسي لقيام مستخدمي الأراضي بتنفيذ الإدارة المستدامة للأراضي

- ☐ زيادة الإنتاج
- ☐ زيادة الربح (القدرة)، وتحسين نسبة التكلفة إلى العائد
- ☐ الحد من تدهور الأراضي
- ☑ الحد من مخاطر الكوارث
- ☐ انخفاض عبء العمل
- ☐ المدفوعات/ الإعانات
- ☐ القواعد واللوائح (الغرامات) / الإنفاذ
- ☑ الوجاهة والضغط الاجتماعي/التماسك الاجتماعي
- ☑ الانتماء إلى حركة/ مشروع/ مجموعة/ شبكات
- ☑ الوعي البيئي
- ☑ العادات والمعتقدات والأخلاق
- ☑ تعزيز المعرفة والمهارات في مجال الإدارة المستدامة للأراضي
- ☐ تحسينات جمالية
- ☑ التخفيف من حدة الصراع

استدامة أنشطة النهج

هل يمكن لمستخدمي الأراضي الحفاظ على استدامة ما تم تنفيذه من خلال النهج (بدون دعم خارجي)؟

- ☐ لا
- ☐ نعم
- ☑ غير مؤكد

الاستنتاجات والدروس المستفادة

نقاط القوة: وجهة نظر مستخدم الأرض

- Enhanced groundwater understanding: The 3D model helped farmers visualize aquifer connectivity, which improved their awareness of water scarcity and led to better planning
- Collective decision-making: The approach promoted social cohesion and encouraged joint management of groundwater as a common resource.
- Practical application: Enabled decisions on water budgeting, cropping patterns, and site selection for recharge structures
- Inclusiveness: Encouraged participation of all sections of the village including women and marginal landholders
- Created a visual tool that villagers could present in Gram Sabha meetings and discussions with local authorities

نقاط القوة: وجهة نظر جامع المعلومات أو غيره من الأشخاص الرئيسيين لمصدر المعلومات

- Bridges science and local knowledge: CoDriVE-VI effectively demystifies hydrogeology by integrating local understanding with technical surveys
- Low-cost and replicable: Uses locally available materials (e.g., cardboard) and community manpower.
- Supports policy alignment: The approach aligns with national programs like NAQUIM and Atal Bhujal Yojana, enabling scale-up
- Encourages behaviour change through experiential learning—participants shift from individual to community-centered groundwater thinking

نقاط الضعف / المساوىء / المخاطر: وجهة نظر مستخدم الأرضكيفية التغلب عليها

- Time-consuming model preparation: Building the physical 3D model takes effort and coordination. Train local youth/facilitators to manage the model-building steps and streamline the process
- Initial difficulty in understanding hydrogeological concepts: Terms like "resistivity" or "aquifer" were hard to grasp Use simplified language, analogies, and step-by-step facilitation.
- Models can be physically damaged over time Store models in safe, community-designated spaces or digitize versions where feasible.

نقاط الضعف / المساوىء / المخاطر: وجهة نظر جامع المعلومات أو غيره من الأشخاص الرئيسيين لمصدر المعلوماتكيفية التغلب عليها

- Limited scalability without facilitation support: While the model is low-cost, initiating the process requires trained facilitators Create a cadre of local groundwater ambassadors trained in CoDriVE-VI.
- Not linked directly to economic incentives: Without immediate financial benefits, long-term engagement may decline. Integrate with livelihood programs (e.g., water-efficient cropping, irrigation advisories).
- Not institutionalized within local governance systems Advocate for formal integration into Gram Panchayat and watershed planning protocols.

المراجع

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https://qcat.wocat.net/ar/wocat/approaches/view/approaches_7555/

بيانات الإدارة المستدامة للأراضي المرتبطة
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تم تسهيل التوثيق من قِبَل

المؤسسة
- Watershed Organisation Trust (WOTR) - الهند

المشروع
- غير متاح

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