



Applying the Parameters of Impacted Population and Gully Social Impact Factor to Prioritize Choice of Gully Erosion Intervention Programs in Resource Limited Settings: Lessons from World Bank Funded Intervention in Anambra State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/jgeesi/2024/v28i6778>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/117808>

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ABSTRACT

Background: Following a presidential request for assistance in the gully erosion menacing many States in Nigeria, the World Bank intervened through the Nigeria Erosion and Watershed Management Program (NEWMAP) in 23 States including Anambra, from 2014 - 2022. This study examined NEWMAP's intervention in order to learn crucial lessons to improve subsequent gully remediation interventions in Anambra State.

Methods: A 7-man multidisciplinary focus group was constituted to study NEWMAP's intervention in Anambra State, determine the most striking innovation in the intervention, and explore that innovation further. Data extraction, content analysis comparative analysis, rational decision framework and the deductive model were applied to make findings and draw conclusion.

Results: The study found that: (i) the most striking innovation in NEWMAP's intervention in Anambra State is the introduction of elaborate and comprehensive package of rehabilitation of impacted population. (ii). 13 major gully erosion sites were remedied totaling 32 544.87 meters long and directly impacting a population of 163 209 persons (iii). As at June 2021, 150 000 impacted population had benefitted from micro-credit grants to engage in alternative livelihood businesses that contributed in revamping the State's economy. (iv). The 13 gully sites remedied had a wide range of gully social impact factor, the highest three values being 101 440; 67 587.5 and 41 778; while the lowest three values are 1 204; 1 694.7 and 3 186.

Conclusion: The study concludes that elaborate and comprehensive package of rehabilitation of gully impacted population is an innovation in Anambra State introduced by NEWMAP; that gully impacted population is a good measure of vulnerability; and that the parameters of impacted population and gully social impact factor are sensitive, reliable and effective parameters to prioritize choice of gully intervention programs in resource-limited settings.

Keywords: Anambra State; gully erosion; impacted population; livelihood support; NEWMAP; rehabilitation; vulnerability; World Bank.

ABBREVIATIONS

ANSEMA : Anambra State Emergency Management Agency
CIGs : Community Interest Groups
FEMA : Federal Emergency Management Agency
IDPs : Internally Displaced Persons
NEWMAP : Nigeria Erosion and Watershed Management Project
NGOs : Non-Governmental Organizations
OPS : Organized Private Sector

1. INTRODUCTION

With about 1,000 active gully erosion sites in a small landmass of about 4 887sq. km, Anambra State of Nigeria has been variously described as the gully erosion capital of the country [1,2]. It is widely known that not only are the gully sites neglected, the impacted population are often neglected, even when engineering and landscape restoration interventions are implemented. Following special request by Nigeria's President for assistance for States in the country most affected by gully erosion, the

World Bank intervened through the Nigeria Erosion and Watershed Management Project (NEWMAP). Anambra State is one of the 23 States that benefitted from the NEWMAP intervention in Nigeria. The Anambra State NEWMAP project commenced in 2014 and closed out in 2022 with a detailed end-project report. This study aims to highlight the most important lesson learnt from the NEWMAP intervention in Anambra State in order to apply same to inform new policies and improve future interventions.

2. METHODS

A 7-man multidisciplinary focus group was constituted to study NEWMAP's intervention in Anambra State to identify the most striking innovation in the project intervention, and to explore that innovation further to learn useful lessons. To ensure broad spectrum perspective, the multi-disciplinary fields covered by the composition of the focus group include health systems development, environmental safeguard and project management, social geography, environmental inspection and compliance, public administration, dental technology and ecology. Decisions of the focus group were reached through consensus or majority vote.

During focus group voting, social rehabilitation of gully impacted population, as the most striking innovation excelled with 4 points over six other hallmarks of the NEWMAP intervention in Anambra State. These other hallmarks scored the following votes: advanced precision engineering and landscaping restoration (2 points); proactive funding and fiscal responsibility including transparency and accountability (1 point); community mobilization for community ownership and sustainability (1 point); expert and comprehensive pre-project feasibility studies (0 point); dedicated project management approach (0 point); and supportive supervision with monitoring and evaluation (0 point).

Data extraction was done to sift out data directly relevant to the impacted population. Content analysis, comparative analysis, rational decision approach and deductive model were applied on extracted data in order to arrive at findings and draw conclusion.

3. RESULTS

3.1 Data Presentation

The following data that are relevant to our theme are extracted from NEWMAP's record.

3.2 Data Analysis

Extracted data presented above are amenable to the following three analyses.

3.3 Summary of Preliminary Findings

- In eight years of its operation in Anambra State, NEWMAP remedied 13 major gully erosion sites located in 11 autonomous communities, with two autonomous communities (Awka and Obosi) having two project sites each.

- The 13 intervention works involved a remediation of gullies totaling 32 544.87 meters in length; 929.93 meters in average width; and 245.6 meters in average depth.
- The 13 gully sites directly impacted a total population of 163,209 persons, with a mean value of 12 555 persons impacted per gully site.
- The 13 gully sites have a wide range of gully social impact factor. The highest three sites (Amachala, New Heritage/Omagba and St. Thomas Aquinas /Neros Plaza) have gully social impact factors of 101 440, 67 587.5 and 41,778 respectively; while the lowest values of 1 204, 1 694.7 and 3 186 belong to Ire-Obosi, Ojoto and Ugamuma-Obosi gully sites, respectively.
- In respect of rehabilitating the impacted population, data for four pilot sites/communities show that 1 255 persons were directly rehabilitated with livelihood support for alternative economic engagement through 62 Community Interest Groups (CIGs) that serve as local cooperative societies.
- A total of one hundred and ten million, fifty four thousand and eight hundred Naira (N110 054 800.00) were disbursed to selected beneficiaries, averaging a direct disbursement of eighty-seven thousand, six hundred and ninety three Naira (N87 693) per beneficiary.

4. DISCUSSION AND MAJOR FINDINGS

4.1 Is Rehabilitating the Population Directly Impacted by Gully Erosion an Innovation in Anambra State?

It is not in contention that persons impacted by flooding in Anambra State, like in other States of Nigeria, are more adequately catered for. Intervention activities, from early warning broadcasts, through assisted evacuations to internally displaced persons (IDPs) camps and to all-round maintenance in IDP camps are well known [5,6]. Even a Flood Rapid Needs Assessment Dashboard has been established [7]. These intervention activities concertedly come from the Local Government Councils of affected areas; the Anambra State Government through the Anambra State Emergency Management Agency (ANSEMA); the Federal Government through the Federal Emergency Management Agency (FEMA); and a host of

Donor Agencies, International, National and Local Non-Governmental Organizations (NGOs), Missions, the Organized Private Sector (OPS) and philanthropists.

Unfortunately, the same show of concern cannot be said of persons impacted by gully erosion, whose experienced are abject neglect and marginalization. Out of about 1000 active gully erosion sites in Anambra State, only about 3 - 5% are reported to have received or are receiving remedial attention [8,9]. The rest gully sites, some of which are more than 15 years old, remain unattended, and so it is with their respective impacted populations.

More disheartening is that even when remedial intervention commence, such intervention focus only on physical engineering remediation and landscape restoration. The direct socio-economic rehabilitation of the impacted population has not been part of the domestic Government's plan of action. For instance, from year 2000 to 2021, Anambra State Government executed 44 gully remediation projects in the State but none of these projects contained any package of direct socio-economic rehabilitation program for impacted population. Similarly, between May 2015 and October 2022, the Federal Government of Nigeria executed 7 erosion remediation projects in Anambra State [9]. Again, none of these contained any special package of direct socio-economic rehabilitation of impacted population.

In contrast however, between 2014 and 2022, the World Bank funded Nigeria Erosion and Watershed Management Project (NEWMAP) executed 13 gully erosion remediation works in Anambra State as shown in Table 1. Each and every of the said 13 project sites has a comprehensive and elaborate package of socio-economic rehabilitation program for the impacted population [3,4].

Such package include:

- Mapping and enumeration of impacted population.
- Sensitization and mobilization of impacted population and communities.
- Training on skill acquisition for alternative livelihood engagement.
- Formation of various communitybased groups including Community Interest Groups (CIGs) that serve as cooperative

societies for micro and small scale enterprises.

- Disbursement of micro credit to successful beneficiaries for alternative livelihood businesses (see Table 2).
- Supervisory support.
- Other community ancillary assistance for local ecosystem preservation such as distribution of efficient cook stoves to promote low carbon and climate resilience in project communities.
- etc.

Indeed and undoubtedly, factoring-in impacted population, as well as comprehensive and elaborate package of socio-economic rehabilitation of impacted population are innovations introduced in Anambra State by the World Bank funded NEWMAP. This is a global best practice that the World Bank has consistently maintained in its operations. Aligning this policy principle to the case of Anambra State, Michael Ivenso, NEWMAP's Project Coordinator for Anambra State explained that:

NEWMAP is inarguably the most ambitious and most successful landscape restoration and climate adaptation project in the history of Anambra State. An innovative and people focused intervention led to the game changing results across communities in the State. It is through adopting time-tested global best practices in environmental governance and social mobilization that we can reverse the devastating impacts of gully erosion and flood inundation [10].

We are in total agreement with this view. It is for this innovative approach and the transformational impact on the people that NEWMAP in Anambra State was nicknamed "game changer", a nickname that became so popular that it was apparently adopted as official slogan, reflecting in some official documents of the agency.

4.2 Is the Rehabilitation of Population Impacted by Gully Erosion in Anambra State a Strategic Socio-Economic Driver?

Table 2 shows NEWMAP's pioneering grant disbursement to CIGs/beneficiaries for alternative livelihood support in four pilot intervention sites. Its analysis, provided in Table 5, shows that for 62 CIGs comprising 1 255 total beneficiaries (average of 20 person/CIG), the

sum of N110 054 800.00 was disbursed as grants. This gives an average of N87 693 per beneficiary. By June 2021, the number of beneficiaries was reported to have reached 150 000 [11]. If we project an estimate of possible total disbursement from this average interim

disbursement, it implies that about N13.15 billion was disbursed as grants to 150,000 beneficiaries that formed about 7 500 CIGs/cottage business in Anambra State. The economic implications of this NEWMAP social package is far-reaching for Anambra State.

Table 1. Gully Erosion Sites Remedied in Anambra State by NEWMAP Showing Impacted Population

S/No	Name of Gully Site	Size of Gully	Impacted Population
1	St. Thomas Aquinas / Neros Plaza	Length 122m; Average width 18m; Depth 8m.	5 097
2	Amachala	Length 50m; Average width 30-40m; Depth 20m.	5 072
3	New Heritage/ Omagba	Length 400m; Average width 25m; Depth 15m.	27 035
4	Ekwueme Square/ Federal High Court	Length 0.32 and 0.05km; Average width 20m; Depth 16m.	5 023
5	Ugamuma – Obosi	Length 4 303m; Average width 17.7m; Depth 5.1m	13 700
6	Ikenga Ogidi	Length 1 697m; Average width 17.7m; Depth 5.1m	17 140
7	Enugu-Ukwu	Length 1 927.87m, Average width 5.86m, Depth 4.7m	10 000
8	Abidi Umuoji	Length 2 400m; Average width 23.5m; Depth 23.1m	16 274
9	Nkpor Flyover	Length 1 545m; Average width 505m; Depth 20m	11 000
10	Nnewichi	Length 3 730m; Average width 110m; Depth 27m	52 824
11	Ojoto	Length 3 950m; Average width 41m; Depth 33m	6 694
12	Ire-Obosi	Length 4 150m; Average width 103m; Depth 53m	5 000
13	Abagana	Length 7.9km (incomplete data)	8 352

Source: Extracted from ANAMBRA STATE, NEWMAP..... A GAME CHNAGER. VOL 2, pp 8 - 9 (ANAMBRA NEWMAP 2019) [3]

Table 2. Livelihood Support Rendered to Some Impacted Population in Four Pilot Gully Sites/Communities in Anambra State by NEWMAP

S/ No	Gully Site/Community	Total No of CIGs+	Total Beneficiaries	Male	Female	Total Amount Disbursed (N)
1	Abagana	14	284	133	151	35 178 960.00
2	St. Thomas Aquinas/ Neros Plaza	18	451	240	211	35 767 550.00
3	Amachala	5	135	69	66	11 032 300.00
4	Omagba	25	385	169	216	28 077 990.00
Total		62	1 255	611	644	110 054 800.00

+ CIGs means Community Interest Groups

Source: Extracted from ANAMBRA STATE NEWMAP... A GAME CHANGER. VOL.2 p.37 [4]

Table 3. Summary Analysis of Dimensions of 13 Intervention Works Executed in Anambra State by NEWMAP

S/No	Parameter	Highest Individual Value	Lowest Individual Value	Total Value	Mean Value
1	Gully Length	7900m	50m	32 544.87 m	2 503.38 m
2	Gully Average Width	505m	5.86m	929.93 m	71.46 m
3	Gully Depth	53m	4.7m	245.26 m	18.85 m
4	Population Impacted	52 824	5 000	163 209	12 554.54

Table 4. Analysis of Gully Site Impact on the Population (Based on Table 1)

S/ No	Name of Gully Site	Size of Gully (Length, Width, Depth, in meters)	Population Impacted	Gully Magnitude (Length x Width x Depth)	Gully KM Distance (Length in meters /1000)	Gully Social Impact Factor+ (population impacted per Km distance)
1	St. Thomas Aquinas /Neros Plaza	122m; 18m; 8m	5 097	17 568	0.122	41.778
2	Amachala	50m; 35m; 20m	5 072	35 000	0.05	101 440
3	New Heritage/ Omagba	400m; 25m, 15m	27 035	150 000	0.4	67 587.5
4	Ekwueme Square/ Federal High Court	320m; 20m; 16m 50m; 20m; 16m	5 032	118 400	0.37	13 600
5	Ugamuma – Obosi	430 3m, 17.7m 5.1m	13 700	388 431.81	4.3	3 186
6	Ikenga Ogidi	1 697m; 5.87m; 4.7m	17 140	46 818.53	1.70	10 082
7	Enugu-Ukwu	1 927.87m; 5.86m; 4.7m	10 000	53 097.40	1.92	5 208
8	Abidi Umuoji	2 400m; 23.5m; 23.1m	16 274	1 302 840	2.4	6 780.8
9	Nkpor Flyover	1 545m; 505m; 20m	11 000	15 604 500	1.55	7 096.7
10	Nnewichi	3 730m, 110m, 27m	52 824	11 078 100	3.73	14 161.9
11	Ojoto	3 950m, 41m, 33m	6 694	5 344 350	3.95	1 694.7
12	Ire-Obosi	4 150m, 103m; 53m	5 000	22 654 850	4.15	1 204
13	Abagana	7 900m; (incomplete data)	8 352	-	-	-

+ In essence, gully social impact factor reflects the average number of persons directly impacted by a gully within a uniform standard stretch of the gully's entire length, in this case, per Kilometer distance of gully length

Table 5. Analysis of Livelihood Support to Some Impacted Population (Based on Table 2)

S/N	Name of Gully Site/ Community	No of CIGs	No of Beneficiaries	Average No of Beneficiaries in Each CIG	Amount Disbursed (N)	Average Amount Disbursed to Each Beneficiary (N)
1	Abagana	14	284	20	35 178 960.00	123 870
2	St. Thomas Aquinas /Neros Plaza	18	451	25	35 765.550.00	79 302
3	Amachala	5	135	27	11 032 300.00	81 720
4	Omagba	25	385	Approx. 16	28 077 990.00	72 930
	Total	62	1 255	20	110 054 800.00	87 693

First, there are, of course, many ancillary activities that preceded and followed NEWMAP's disbursement of livelihood support grants to beneficiaries. These include training and capacity

building, feasibility studies, town hall meetings, consultancy services, supervision, extension services, etc. We estimate that the cost of these ancillary activities shall be about 50% of the

direct disbursement of grants for livelihood support, which shall translate to about N6.57 billion. Adding this amount to the direct grant disbursement of N13.15 billion implies that an estimated investment of approximately N20b were expended by NEWMAP in Anambra State for all livelihood support related activities. This is a huge investment that positively impacted the State economy.

Second, NEWMAP's direct grant disbursement of about N87 693 to individual beneficiaries (see Table 5) favourably compares with "trader moni" and 'conditional cash transfer schemes" of the Federal Government's poverty alleviation programs. The trader moni scheme commences with a non-collateral and interest free soft loan of N10 000 and increases progressively through N20 000, N50 000, etc, until a maximum of N300 000, subject to successful repayment of previous loan levels. The conditional cash transfer scheme involves monthly transfer of N25 000 for 3 months usually, but a maximum of 6 months. Without prejudice to various complaints of opacity bedeviling these schemes, Vanguard [12]. reports that as at 2021, 16 105 persons from Anambra State had benefited from the trader moni scheme. Comparing this figure with 150 000 beneficiaries for the NEWMAP livelihood support grant puts the latter as a premium poverty alleviation mechanism.

Third, from NEWMAP's records, beneficiary CIGs/cottage businesses which record about 100% survival rate engage in the following productive ventures: fishery, pig farming, palm oil processing, snail farming, cassava processing, liquid soap production, metal fabrication, etc. For about 7 500 cottage business to be simultaneously engaged in various production activities listed above, with all their value chain, is a critical driver and stimulant to the economy of Anambra State.

There are numerous life- experience testimonies including commendation letters and recorded interviews from beneficiary communities, groups and individuals evidencing the impact of NEWMAP's rehabilitation of impacted population [3]. According to Mr. Innocent Obasi who is the Chairman of Omagba community Association (hosting the gully site listed in serial no. 3 in Table 1):

The icing on the cake is the formation and training of Community Interest Groups where people are given seed money to

start any business of their choice. Today we have those in fish farming, iron bending, soap making, tailoring, name it. (p.13)

The testimony of one Mrs. Veronica Ekuno from Abagana community (hosting gully site listed at serial no.13 of Table 1) sums up more appropriately the economic impact of their rehabilitation, thus:

Apart from the civil work they are doing, they are also empowering some of us who are economically vulnerable to be able to take care of our families. I belong to the Uzoamaka Poultry CIG, and our birds are growing, we have made sales and stocked our farm with more chicks. My daughter is being trained in the ICT Group and you know that with ICT you have the world at your fingertips. With what NEWMAP is doing, the project has made an indelible impression in our lives (p.14).

4.3 Are Gully Impacted Population and Gully Social Impact Factor Effective Parameters to Prioritize Choice of Gully Intervention in a Resource-Limited Setting?

Consideration for human welfare is at the centre of vulnerability mitigation and resilience building. All on-site and off-site effects of gully ultimately impact the population, directly or indirectly, immediately or remotely. It is therefore pertinent that those directly impacted by gully erosion be considered and treated as vulnerable groups, as much as those impacted by flooding. Accordingly, their vulnerability measure will be indicated by the number of persons directly impacted and the extent of severity of the impact. Hence, direct and severe impact will include damage or loss of dwelling houses, loss of farmland and livestock, damage to infrastructure and amenities, loss of livelihood business, and cut-off of strategic access/ communication routes. The extreme trauma and agony of victims who experienced loss of farmland and dwellings are well captured by Iruoma [13] and Unah [14] respectively. Hence, all things being equal, the number of persons directly impacted by gullies and the degree of severity of the impact, as indicators of vulnerability, should be effective parameters to prioritize choice of gully remediation intervention when only a few of existing gullies are to be addressed.

Table 3 shows a summary analysis of some values of the 13 gully intervention projects executed by NEWMAP in Anambra State amounting to a total length of 32,544.87 meters directly impacting a total population of 163,209 persons. Table 4 provides a summary analysis of the contents of Table 1 while introducing the three parameters of:

- Gully magnitude (m^3) = Gully length x width x average depth, in all meters.
- Gully kilometer distance (km) = length of gully (m) / 1000.
- Gully social impact factor = Population impacted per kilometer distance of gully.

Further analysis shows that the three longest gullies with complete data (Ire-Obosi: 4 150m; Ugamuma-Obosi: 4 303m; and Ojoto: 3 950m) respectively take the 12th, 5th and 9th positions in terms of numbers of population impacted; and 12th, 10th and 11th positions respectively in terms of gully social impact factor. Similarly, the three gullies with the highest value of gully magnitude (Ire-Obosi: 22 654 850; Nkpor Flyover: 15 604 500; and Nnewichi: 11 078 100) have low social impact factors of 1 204; 7 096.7 and 14 161.9 respectively. In contrast, three short gullies (Amachala: 50m; New Heritage/Omagba: 400m; and St. Thomas Aquinas: 122m) have the highest gully social impact factors of 101 440; 67 587.5, and 41 778, respectively.

If gully social impact factor as enunciated in this study were to be applied on prioritizing the 13 gullies remedied by NEWMAP in Anambra State, the topmost priority will go to Amachala gully erosion site despite being the shortest gully erosion site of 50 meters in length, while the least priority will go to Ire-Obosi gully erosion site despite being the longest gully (4 150m) with complete data and being also the biggest gully with the highest gully magnitude (22 654 850). This proves that our gully social impact factor is a sensitive, reliable and effective parameter for prioritizing choice of gully intervention activities in resource-limited settings. This is especially apt for Anambra State where not more than 5% of existing gully erosion sites have received or are receiving remedial attention [9].

Though it appears easy to recognize gullies where they exist, the definition and uniform classification of gullies (by their physical attributes) is difficult. In this regards, there is still apparent disorder in definition, terminology and categorization for which consensus is

rudimentary [15,16,17]. It is even far more difficult to classify gullies accord to their impacts and severity. A modest attempt in this regards was made by Okoye *et al.* [18]. in a United Nations Development Programme (UNDP) funded study in Anambra State in 2013, which was published in 2014. Integrating the three parameters of gully length, gully depth and level of destruction of lives and properties, they classified gullies into four categories: “most severely”, “severely”, “moderately” and “slightly” gullied sites. This method of classification has the obvious flaws of being imprecise, inconsistent and ambiguous. Level of destruction of lives and property wrought by a gully must not be directly related to the gully’s length and depth, as intervening factors such as soil erodibility, rainfall erosivity, settlement pattern, building types, vegetation cover, land use activities and community resilience contribute more in determining outcome of destruction of lives and prosperities. Little wonder that this classification scheme has not found subsequent use both in Anambra State and elsewhere.

Our introduction of gully social impact factor which focuses on a specific and definite unit of gully dimension (per kilometer distance) and the number of persons directly impacted is more precise, unambiguous and more amenable to consistency. It is therefore an improvement on the works of Okoye *et al.* [18].

5. CONCLUSION

The World Bank funded a development assistance in Anambra State involving the remediation of 13 major gully erosion sites through the Nigeria Erosion and Watershed Management Program (NEWMAP) in the 8-year period spanning 2014 to 2022. According to the assessment of a 7-man multidisciplinary focus group, the most striking innovation of the project intervention is the introduction in the State of an elaborate and comprehensive package of socio-economic rehabilitation program for the population impacted by the gullies. The package includes, among others, mapping, enumeration, mobilization, training/capacity building and micro credit grant for alternative livelihood support to selected impacted population.

The focus group further determined that the size of population impacted by a gully site is a measure of community vulnerability; that such socio-economic rehabilitation of gully impacted

population is a strategic socio-economic driver of the State's economy; and that the parameters of gully impacted population and gully social impact factor are sensitive, reliable and effective in prioritizing choice of gully intervention works in resource-limited settings.

Moreover, application of the parameters of impacted population and gully social impact factor in prioritizing choice of gully intervention activities becomes more compelling for Anambra State in particular and Nigeria in general, considering that at present, no empirical and rational parameter is applied other than political considerations in prioritizing choice of gully intervention. A Minister of Environment acknowledged the overriding influence of political approach in gully matters in Nigeria [19]. A State Governor has complained bitterly of partisan political affiliation determining choice of gully erosion intervention and funding [20]. Grassroots victims complain of playing politics with gully erosion and the fate of those affected [21,22].

Okpoko and Okpoko submits that for development projects to succeed in the Southeast Nigerian environment "intricate sociocultural issues" must be identified and factored-in in the planning and implementation processes [23,24]. This is what NEWMAP did in her socio-economic rehabilitation package for gully impacted population. This accounts for the reported success of NEWMAP's intervention project [25]. Our enunciation of gully social impact factor further provides a sensitive and accurate compass for more successful navigation of the gully intervention and management decision landscape [26].

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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